Water System Needs and Alternatives

Section 7

7.1 Needs Summary

This Section evaluates water system improvement needs over the 20-year planning period due to the projected growth presented in Section 2 and corresponding increases in water demand presented in Section 6. This growth will require expansion of system capacity and improvements to ensure the ability to deliver potable water and fire protection water for the entire service area. Additionally, public infrastructure components will continue to age and degrade over time potentially requiring improvements to remain functional and reliable.

The purpose of this section is to present various alternatives for the major infrastructure components along with analysis and background information that will be required to make an informed selection from the presented alternatives.

For the purposes of this study, the major infrastructure components are divided into the following divisions:

- Raw Water Supply
- Water Treatment
- Water Storage
- Distribution

The following subsections will address each of these areas independently.

7.2 Raw Water Supply Alternatives

Perhaps the most critical long-term issue facing the City of Newport is that of raw water supply. Without adequate raw water, treatment and distribution capacity is of little importance. Therefore, it is critical that viable alternatives are explored to ensure adequate supply for the planning period. Since it is often difficult and costly to develop new raw water supplies, and such efforts can take many years, the City should also be preparing for long-term needs beyond the planning period such as required in 30, 40 or even 50 years.

The City should be capable of providing water (supply and treatment) for the projected maximum daily demand (MDD). Diurnal flows such as peak hourly flows occurring for shorter periods each day will exceed supply and treatment capacity however these demands are met through distribution storage. Section 6 includes analysis and development of the maximum daily demand for the current planning period as well as projections beyond the planning period. A summary of the MDD flows that are to be used for this analysis are as follows:

Table 7.2-1 – Summary of Maximum Daily Flow Projections

Year	Flow (MGD)	Flow (gpm)	Flow (cfs)
2008	4.10	2,847	6.34
2030	5.80	4,028	8.97
2050	7.50	5,208	11.60
2070	9.60	6,667	14.85

Based on the above table, the City must ensure that they have raw water supplies totaling around 5.80 MGD for the planning period, 7.50 MGD for the next planning period, and 9.60 MGD beyond.

Newport's existing supply consists of runoff in the Big Creek basin supplemented in summer months by pumping from the Siletz River into the Big Creek Reservoir. Existing supply is adequate for the current MDD of 4.1 MGD. Analysis is needed to determine what improvements if any are needed to meet the 2030 MDD and beyond. Detailed planning for needs beyond the 20-year planning period is beyond the scope of this Plan however a general analysis and alternatives are presented.

7.2.1 Groundwater Alternatives

It is generally understood that groundwater wells along the coastal zone are a "hit and miss" proposition and that obtaining adequate supply for a City the size of Newport through wells is unlikely.

As part of this analysis, the well logs for all of the township/range combinations in and around the study area were reviewed to determine the average and maximum well yields in the area. Data was obtained from the Oregon Water Resources Department database and the maximum well yields reviewed for Townships 10S, 11S, and 12S in Range 11W. The results of that analysis are as follows:

Table 7.2-2 – Groundwater Well Yields in Newport Area

Township/Range	Average Maximum Yield (gpm)	Maximum Yield (gpm)
10S-11W	6	45
11S-11W	7.5	60
12S-11W	9.5	85

As stated earlier in this section, the City will require source water on the order of thousands of gallons per minute. Therefore, the small yields that could be expected from coastal wells will not make an appreciable contribution toward solving Newport's water needs.

No additional efforts were made to investigate the potential for development of groundwater resources for the purposes of providing raw water to Newport.

7.2.2 Surface Water Alternatives

Along the Oregon Coast, the vast majority of public water systems rely on surface water supplies to provide adequate volumes of raw water to serve their customers. Section 5 outlines the current raw water supplies utilized by the City of Newport and the corresponding water rights.

Siletz River – The City currently holds water rights on the Siletz River totaling 6.0 cfs or 2,693 gpm. This water right will meet the 2030 planning requirements when combined with the Big Creek water right and storage reservoir assuming that the City of Newport will always be able to divert the entire water right from the river during summer periods.

An analysis of Siletz River streamflows recorded at USGS gauging station 1430550 near the City's intake was completed using data from 1904 to 2006. Average mean monthly flow ranged from a high of 2364 cfs in 1933 to a low of 863 cfs in 1944 with an average of 1516 cfs. The lowest streamflow month is August with a mean of 130 cfs. The lowest monthly flow recorded was 62.5 cfs in August 2003. The lowest daily flow recorded was 42 cfs on September 6, 2003. In terms of streamflow, the driest year on record was 1944. Figure 7.2-1 illustrates the daily streamflows in the Siletz River near the City's intake between 1990 and 2006.

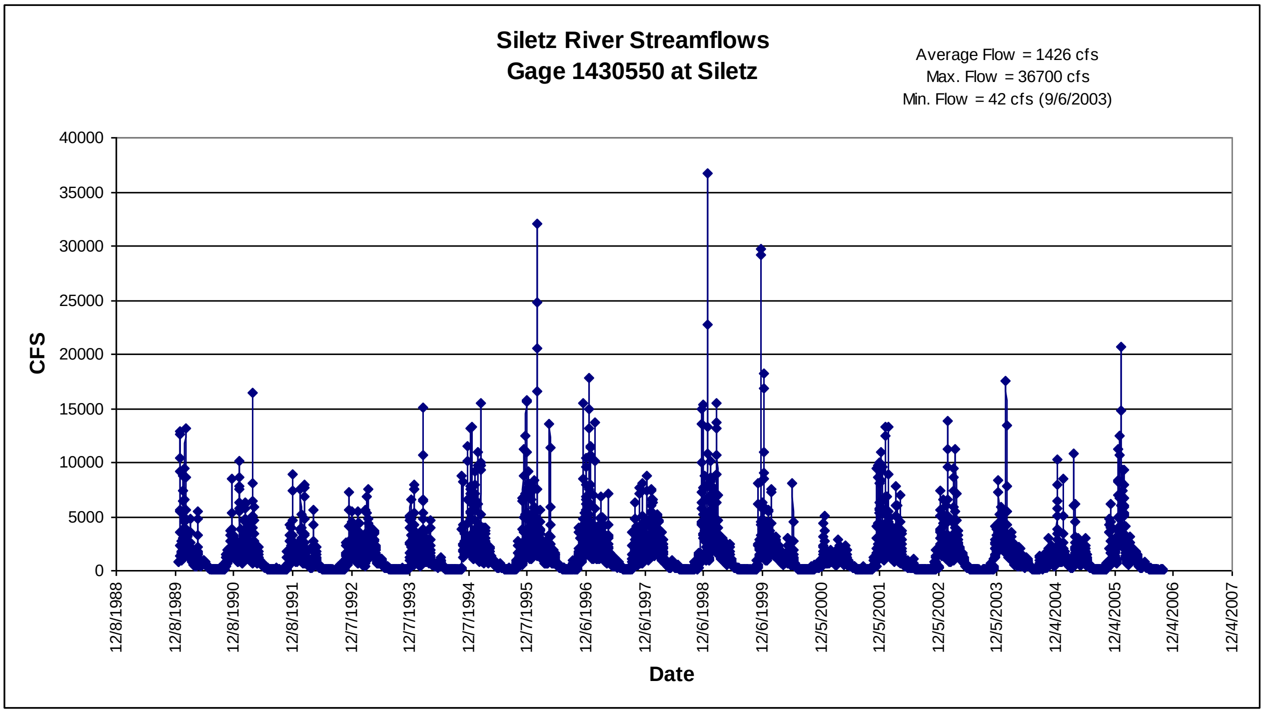

Figure 7.2-1 – Siletz River Daily Streamflows, 1990-2006

The Siletz River basin includes approximately 202 square miles of drainage area. A number of other large water rights exist on the Siletz River. Streamflows have always been great enough to supply Newport's water right as well as all other senior municipal rights. Georgia Pacific's large industrial right is through a combination of Siletz River flows, Olalla Creek flows, and Olalla dam storage. A summary of these rights is provided below in Table 7.2-3.

Table 7.2-3 – Siletz River Water Right Summary - (Priority Dates Senior to 9/24/1963)

Holder of Right	Priority Date	Water Right (MGD)	Water Right (cfs)
City of Newport	*9/24/1963*	*3.88*	*6.0*
Siletz Tribe	1957		0.26
City of Siletz	1944 & 1953	0.48	0.75
City of Toledo	1929	2.59	4.0
City of Toledo	1937	1.13	1.75
JJ Killip	1934	0.65	1.0
US Public Housing Admin.	1945	1.94	3.0
Georgia Pacific (Industrial)	1956 &1963	22.62	35.0
Int. Paper (Industrial)	1933	1.29	2.0

As part of this planning effort, some discussions have been held with other communities regarding the potential for a water rights purchase or transfer. There has been no interest from any of the parties we talked with as water rights in this area are a tightly held and valuable commodity. It is extremely unlikely that any new municipal water rights on the Siletz will be given.

Big Creek Basin

The Big Creek basin currently provides water to the City of Newport through the collection of runoff from the basin within the Big Creek Reservoirs. The entire Big Creek basin is around 2.8 square miles in area. The entire basin above the City's allowed point of diversion is collected in the reservoirs and cannot be expanded; therefore, all of the water that could be collected and used from the Big Creek Basin is being utilized.

The only potential improvement to the Big Creek Basin that would enhance the City's raw water supply is to increase the capacity of the Big Creek storage reserves. This could be accomplished by either raising the existing upper dam or by constructing a new and higher dam in front of the existing dam. These options will be discussed further below in the raw water storage discussion in Section 7.2.3.

Rocky Creek Basin

Another potential source of raw water for Newport would be the Rocky Creek basin located north of the City and south of Depoe Bay. The basin that drains into Rocky Creek and into the Pacific has long been the subject of discussion as a potential location for a dam and reservoir that could benefit a regional area as a drinking water supply. The Rocky Creek basin has an overall drainage area of approximately 5.35 square miles.

Without a dam and major reservoir, Rocky Creek itself cannot provide adequate water to the City of Newport during the summer months. In preparation for long-term supply from Rocky Creek, the City applied for water rights on Rocky Creek totaling 6 cfs. The water rights are currently in the application stage.

Additional discussion on the potential for the Rocky Creek Dam is discussed below in Section 7.2.3.

7.2.3 Raw Water Storage Alternatives

Big Creek Reservoir – New Dam

The City currently utilizes two reservoirs located at the base of the Big Creek drainage basin. According to records, the upper reservoir includes approximately 970 acre feet of storage. The lower reservoir is credited with an additional 200 acre feet of storage.

The City utilizes flows generated within the Big Creek basin much of the year when rains generate adequate runoff to maintain full reservoirs. As rainfall diminishes and demand increases, the City must pump water from the Siletz River into the Big Creek Reservoir to maintain adequate reservoir levels and raw water reserves. Historically, the City has only pumped from the Siletz when it was absolutely necessary in an effort to minimize pumping and operating costs.

One alternative to increase raw water reserves would be to increase the volume of storage that is available within the Big Creek reserves. This would require raising the upper dam or constructing a new dam on Big Creek that would increase the volume in reserves through either an increased water surface, and expanded area, or both.

The City's long-range water supply study (Fuller and Morris, June 1997) developed costs for the development of a new dam located midway between the upper and lower reservoir. This approach would allow the new dam to be constructed and utilize the existing dams to act as cofferdams to protect the construction site and provide water to the City in the interim.

Positive points for this approach include:

- The City already owns most of the property
- The existing dams could provide service and protection during construction
- The higher dam would flood mostly wooded forest areas which is conducive to a healthy watershed.
- Much of the existing infrastructure and the existing plant site can be reused.
- The deeper reservoir would result in less warming and improved water quality.

Negatives to this approach include:

- Cost. The 1997 cost estimate for this project was nearly $10-million. Today, the project would be estimated somewhere between $15 and $20-million. As this project would only benefit Newport customers rather than providing a regional benefit, the individual burden of paying for this project would be great.
- Potential for weak soils in the vicinity could make design and construction a challenge. The cost of the dam could increase dramatically if drilling and geotechnical analysis indicated that special soils work would be required.
- Permitting and environmental issues could prove to be a challenge.
- Residential areas downstream would be further threatened by a larger (higher) dam and the increased volume of stored water.
- There are a few residences constructed in the Big Creek basin near the upper reservoir. These properties would be flooded and the homes would have to be purchased and/or relocated. This may prove difficult from a political perspective.

Big Creek Reservoir – Increased Pumping and Water Volume Management (Water Balance)

The current practice for Big Creek is to utilize runoff originating within the basin for as much of the year as possible. As levels in the reservoir fall, the City begins pumping from the Siletz River to provide the flows needed to provide drinking water until seasonal rains begin filling the reservoir again.

Another alternative is to maximize the amount of water that is diverted from the Siletz River in an effort to keep the Big Creek reservoir as full as possible, as long as possible. This could be accomplished manually or through improved data acquisition and SCADA controls that would be designed to monitor water levels within the reservoir and automatically operate the Siletz River pumps to maintain a full condition through more of the year. Programming could be developed and adapted to take into consideration the output from the reservoir, the time of year, rainfall levels, and other conditions to determine if and when water should be pumped from the Siletz. Furthermore, the programming could be adapted to operate the pumps at night and on an off-peak schedule to reduce power cost impacts as much as possible.

To complete this analysis, all of the available records from the period between 1905 and 2007 were reviewed to determine the driest overall year. The driest year on record thus far was 1944. Table 7.2-4 illustrates the analysis that was completed considering the flows that would be available from the Big Creek Basin, the volume of water that is needed by the City in 2008, the volume of water that is projected to be needed in 2030, and the amount of makeup water that will be required from the Siletz River.

As the table indicates, the City will need to pump water from the Siletz, at a minimum, between June and November to avoid lowering water level in the reservoirs with 2030 water demands. Allowing a slight drop in reservoir levels is also possible by pumping less and perhaps not pumping in late October and November. Based on available flow data, there is adequate water available within the Siletz, and within the City's current water right to be able to meet all of the City's needs for the planning period.

Table 7.2-4 – Big Creek/Siletz Water Balance Analysis

Big Creek Drainage Flows to Reservoir #2

	1988 Master Plan (mgd)	1997 Supply Plan (mgd)	Ratio* Method (mgd)	Big Creek Stream Flow** (MG)	2008 Demand (MG)	2030 Demand (MG)	2008 Siletz Need (MG)	2030 Siletz Need (MG)	Siletz Allowed (MG)
January		25	15.36	476	55	78			120
February		19	16.65	483	50	71			112
March		14.5	12.54	389	52	73			120
April	6.2	10	12.69	186	53	76			116
May	3.8	6	4.60	118	63	89			120
June	2.35	4	4.96	71	79	112	8	41	116
July	1.35	2.5	1.56	42	112	159	70	117	120
August	0.75	1.3	0.95	23	94	133	70	109	120
September	0.4	0.9	0.88	12	66	93	54	81	116
October	0.25	0.2	1.20	6	58	82	51	75	120
November	1.1	2	11.27	33	50	71	17	38	116
December	6	7	10.15	186	54	77			120
				2024	785	1112	271	462	1416

* Ratio of Siletz Gage Drainage Area to Big Creek Reservoir #2 Drainage Area (2.8 mi^2 / 202 mi^2), Driest Year on Record of 1944
** Based on lowest of 3 Data Sets

This analysis is, perhaps, made clearer through a graphic representation. Figure 7.2-2 illustrates the water balance for the Big Creek reservoir using a combination of flows from Big Creek augmented with flows from the Siletz River.

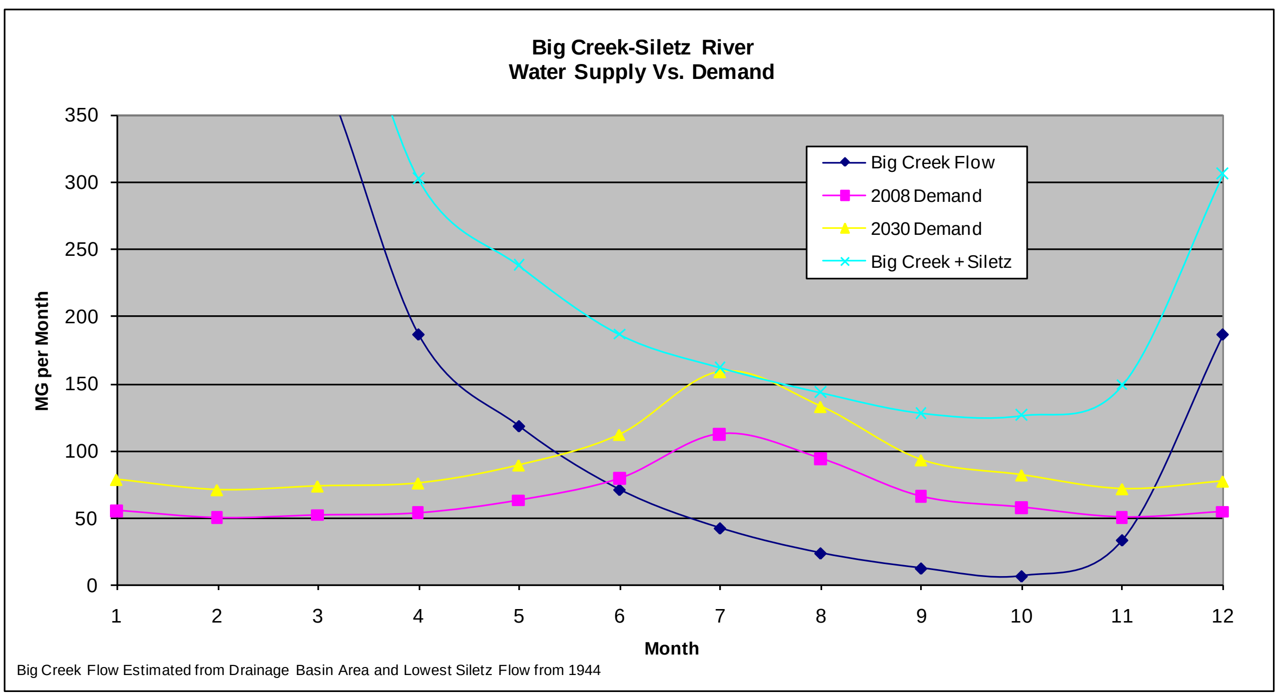

Figure 7.2-2 – Big Creek/Siletz Water Balance Graph

Figure 7.2-2 illustrates that the maximum 2030 water demand for the City of Newport is just met during the driest part of the summer through a combination of Big Creek and Siletz River flows. It is important to remember that this analysis is based upon the driest year on record and should represent a conservative analysis of the available water in the Big Creek and Siletz River basins.

The water balance analysis suggests that no additional storage is required within the planning period or before the projected 2030 demand levels. However, beyond this period, additional reserves will be required or an alternative source of raw water will need to be developed to provide for the potable water needs of the community.

While the water balance approach would allow the City to postpone major improvement costs for their raw water facilities for some time, there will be some increased operating costs due to increased pumping and electrical costs to operate the Siletz pumps more than they are currently operated.

Rocky Creek Reservoir

For some time, there has been an effort underway to develop a regionally-based water supply in the Rocky Creek basin located north of Newport and south of Depoe Bay. To develop this water supply, a relatively large dam would need to be constructed to impound Rocky Creek. Water could then be delivered north to Lincoln City and south to Newport, Seal Rock and beyond.

In 2002, the Central Coast Water Council undertook a study (Rocky Creek Regional Water Supply Project, Preliminary Water Management Plan, CH2MHill, Fuller & Morris, David Evans, January 2002) to investigate the feasibility of developing a regional water supply around Rocky Creek. This effort was preceded by a study completed in 1997 by Fuller & Morris that also touched on the feasibility of a Rocky Creek dam and reservoir project.

Newport and Lincoln City have been the main proponents of the investigation of the Rocky Creek option for some time. While in recent years the Central Coast Water Council has been relatively inactive, the topic of Rocky Creek has not been forgotten.

Without significant additional study, it is difficult to estimate the cost of developing Rocky Creek as a regional water source. Various issues must be addressed including:

- Should Rocky Creek be developed as a full regional facility or building a smaller facility for just Newport and Lincoln City with the ability to expand in the future?
- Does the project include the development of treatment facilities at Rocky Creek so that treated water can be distributed? Or, is raw water distributed?
- What is the alignment and cost of the distribution piping to deliver water from Rocky Creek to the contributing communities?
- What are the environmental, political, legal, or other challenges that will have to be addressed in order to build a new dam on a coastal stream?
- Are there geotechnical or soils issues that are currently unknown? Seismic concerns?
- Who is willing to participate in the project and what will be the financial impact to rate payers for each system participating?
- How will the facility be organized, managed, operated, and maintained? Will a new water entity have to be created? Will a regional water entity operate all of the systems?

Rough calculations place the likely cost of constructing a dam on Rocky Creek and extending piping to the City of Newport to deliver raw water to the treatment plant in excess of $60-million. At that cost, it is clearly not feasible for the City to undertake this project alone.

For Rocky Creek to be viable, it must be undertaken as a regional water effort with as many participating agencies as possible. At a minimum, the Central Coast Water Council should seek to include the following agencies in the discussion about the development of a regional facility at Rocky Creek:

1. City of Newport
2. City of Lincoln City
3. City of Depoe Bay
4. Seal Rock Water District

Additional discussion on the Rocky Creek alternative along with comparison of costs is provided later in this section.

7.3 Water Treatment Alternatives

7.3.1 Current Deficiencies

As discussed in Section 5, the existing water treatment plant is effectively at the end of its useful life. Overall treatment capacity struggles to meet current MDD, structural problems affect the existing clariflocculators and filters, disinfection contact time within the clearwell is insufficient, the existing backwash pump is well beyond its expected service life, plant controls are antiquated and require careful operator attention, and other structural and equipment problems render the existing treatment plant inadequate for the City's future water needs. As water treatment regulations continue to become more stringent, it is increasingly difficult to meet treatment standards using conventional methods. In addition to the treatment problems discussed above, the existing backwash pond has become silted in over the years and there is no practical means for cleaning it. For these reasons, new treatment process equipment and new backwash ponds are recommended to provide for the City's future water treatment needs. Several alternatives capable of meeting the City's future water treatment needs are discussed below.

In addition, it was identified is Section 5 that the lower Big Creek reservoir experiences elevated levels of iron and manganese as well as significant algae growth during the summer months. Treatment is difficult when these conditions persist and it can result in periods of poor water quality. In order to address water quality issues present in the lower reservoir, it is recommended that improvements be made to facilitate use of raw water from a source other than the lower Big Creek reservoir. Alternative raw water sources are discussed below in conjunction with each treatment alternative.

7.3.2 Desalination Treatment (RO)

Many parts of the world struggle to obtain adequate supplies of "fresh" raw drinking water to treat for potable use. These areas are often located in arid regions where surface water is scarce and groundwater is not plentiful. Arid coastal regions, deserts, islands, and other similar areas often struggle to produce enough or an appreciable amount of potable water from fresh water supplies.

The technology to produce potable water from seawater has been available for many decades. However, production of potable water from seawater, normally referred to as desalination or "desal", has historically been considered very expensive. This has been due to expensive equipment and materials as well as high energy costs.

Today, the cost to produce potable water through the use of desalination technologies has been greatly reduced. However, when comparing the cost of desal to treating "fresh" water supplies, the cost remains relatively high.

Desal is currently accomplished through the use of membrane treatment referred to as reverse osmosis or "RO". The exact equipment required and the treatment process varies greatly depending on the quality of the water being treated. Quality parameters that should be considered for desal include:

- TDS (total dissolved solids)
- Conductivity
- Salinity (brackish, seawater, etc.)
- Temperature
- TOC (total organic compounds)

Seawater typically has a much higher level of TDS. TDS levels that would make seawater a good desal candidate would typically be around 5,000 mg/L. TDS levels in the Pacific Ocean near the coastal regions are likely to run between 40,000 and 50,000 mg/L.

Brackish or bay water would be far superior in quality in terms of TDS though the TOC levels can be very high during high runoff periods as well as by tidal impacts. In general, brackish water is considered to require nearly half of the energy costs for treatment as seawater if a suitable brackish source can be obtained.

Normal desalination processes include multiple treatment steps. While the actual processes required may vary depending on the source of the raw water, the following steps or process components are common to a desal treatment process:

1. **Raw Water Intake:** Such as is the case with a conventional treatment facility, a raw water intake is required to divert untreated water into the desal process. Choices for intakes may include

    a. An ocean intake or bay intake with screening to prevent debris, plants, or animals from being pumped into the system. As is the case with any surface water intake, keeping the screen clean and from plugging up is difficult. This would be amplified in a marine environment. Also, there are significant regulatory requirements for intakes to protect fish and other aquatic life from harm.

    b. A beach or bayside well intake. Drilling shallow wells in the sand on the beach or adjacent to brackish sources has the potential to provide a level of pretreatment and avoid screening and other intake issues. However, guaranteeing yield and longevity for any well is often a difficult proposition.

2. **Pretreatment:** Some level of pretreatment is often required to prepare the raw water for further treatment. Depending on the raw water quality, this may include conventional treatment approaches such as chemical flocculation and clarification. The goal of this step in the process would be to eliminate larger debris in the water and reduce dissolved organics such as TOC and TDS. This would typically require conventional flocculation and clarification equipment.

3. **Micro or Ultra filtration (Membranes):** To protect the sensitive and fragile RO membranes, it is not uncommon for a desal facility to include an additional level of pretreatment. This is generally accomplished through the use of micro or ultra filtration membranes or "low pressure"

membranes. The membrane treatment step further reduces debris in the raw water and produces water that is very clean compared to the sea or brackish water source.

4. **Reverse Osmosis (RO or high pressure membranes):** The final step in a typical desal process is RO or high pressure membrane treatment. While regular membranes operate at low pressures often below 50 psi, the RO process generally requires very high pressures to force water through the very small pores in the membrane fibers. While pressures vary depending on the equipment used and the quality of the raw water, it is not uncommon to see desal equipment operating at pressures between 700 and 900 psi. Regular household water pressure is generally between 40 and 80 psi. This high operating pressure accounts for the high energy costs associated with desal or RO treatment. The energy required to generate this high head pressure is costly and usually associated with electrical (pumping) costs.

5. **Waste Disposal:** The desal process takes water that is filled with impurities and produces clean, and nearly pure water. As a result, a significant amount of debris, TOC, TDS and other impurities are generated as they are separated from the finished water. On average, for every gallon of water that is produced using desal, a gallon of highly concentrated waste water must be disposed of. The levels of impurities in the wastewater are significant. As a result, it is difficult to dispose of the waste stream from a desal process in an easy and inexpensive manner. In some cases, the desal waste stream is returned to the ocean. However, fishing industry concerns, dead zone issues, and other environmental concerns make that alternative difficult. It may be possible to introduce the waste stream from the desal plant into the outfall water from a sewage facility. However, this may cause a community to violate their NPDES permit requirements for quality. Treating the waste stream at a wastewater treatment facility may be possible though the highly saline water is problematic for most biological (activated sludge) treatment processes. Also, the volume of water that must be treated is significant. A 10 mgd desal plant in Newport would generate in excess of 10 mgd of waste water that would have to be treated and disposed of (must pull 2 gallons of sea water to generate 1 gallon of treated water plus 1 gallon of waste). The ultimate disposal plan and cost for disposal of a desal waste stream is difficult to predict without significantly more study on the matter.

Many of the desal facilities that are in use in various parts of the world are much larger than the facility that would be required by Newport. The unit cost per gallon (or gallon per day) to construct and operate a desal facility decreases as the size of the facility increases. Figure 7.3.2 indicates the approximate relationship to size and facility cost. The figure shows the approximate capital costs of constructing a typical desal facility vs. the size of the facility. While the costs to construct a facility will vary greatly from one installation to another, the trend is clear that larger plants are less expensive relative to capacity to construct than smaller facilities.

For Newport demands, the unit cost for a desalination plant would be very high and toward the left side of figure 7.3-1. For the current 20-year planning period desalination is not prudent since sufficient lower cost fresh water is available through the Big Creek/Siletz sources. Even for future planning periods beyond 20 years, the unit cost for desal is very high since the City will still first be using the lower cost fresh water in Big Creek/Siletz resulting in a relatively small desal plant.

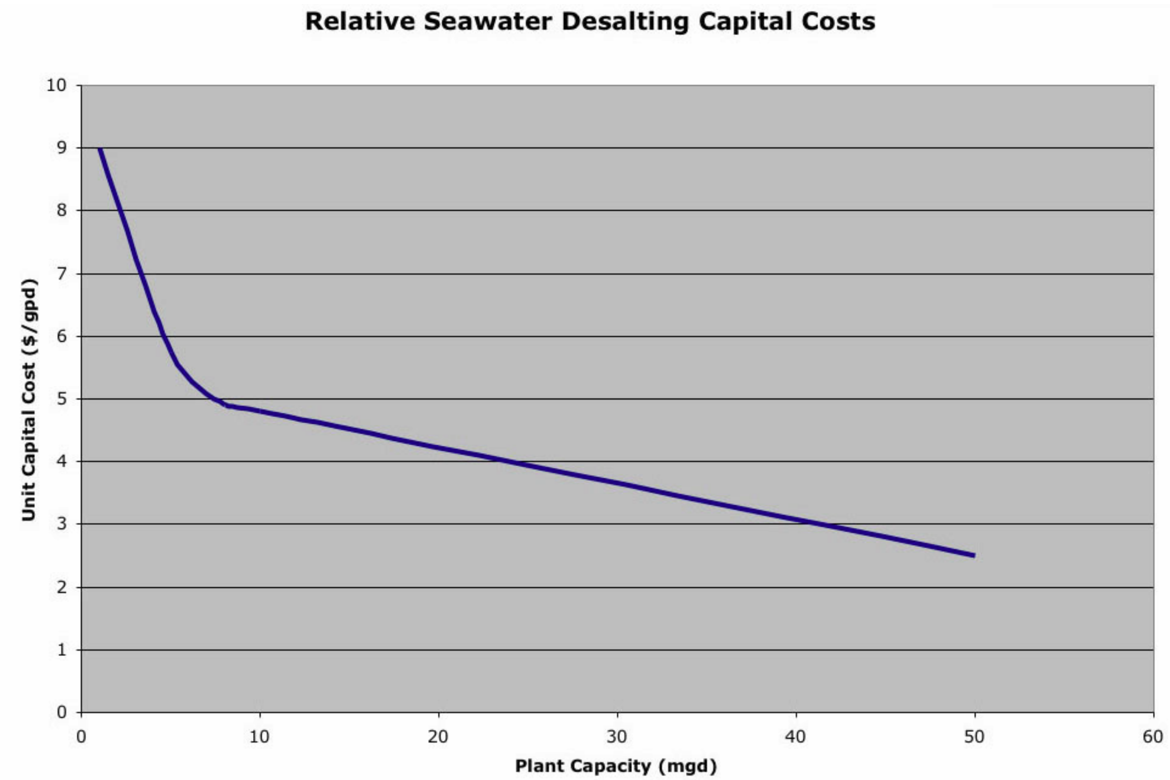

Figure 7.3-1 – Desalination Plant Relative Costs

A preliminary cost estimate was prepared in an effort to quantify the capital cost to construct a desal facility in the Newport area. While significant additional study would be required to refine the estimate, Table 7.3.2 summarizes the preliminary estimate prepared for this planning effort.

Table 7.3.2 – Desalination Treatment Facilities Preliminary Cost Estimate

Desal water plant improvements - 7 MGD					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$7,000,000.00	$7,000,000.00
2	Seawater intake facility	ls	100%	$4,000,000.00	$4,000,000.00
3	Raw water piping to plant site	ls	100%	$750,000.00	$750,000.00
4	New treatment plant building	sf	5,000	$250.00	$1,250,000.00
5	Treatment equipment (pre, MF, RO)	MGD	7	$4,000,000.00	$28,000,000.00
6	Process piping, valves, etc.	ls	100%	$2,000,000.00	$2,000,000.00
7	Outfall/brine discharge facilities	ls	100%	$2,500,000.00	$2,500,000.00
8	Electrical Improvements	ls	100%	$1,000,000.00	$1,000,000.00
9	Controls and telemetry	ls	100%	$200,000.00	$200,000.00
10	Road and site improvements	ls	100%	$500,000.00	$500,000.00
11	Backwash and holding lagoons	ls	100%	$1,000,000.00	$1,000,000.00
12	Backup power generation equipment	ls	100%	$500,000.00	$500,000.00
		Construction Total			$48,700,000.00
		Contingency (20%)			$9,740,000.00
		Subtotal			$58,440,000.00
		Engineering (20%)			$11,688,000.00
		Administrative costs (3%)			$1,753,200.00
		Total Project Costs			**$71,881,200.00**

Based on this estimate, constructing a desalination facility in Newport capable of serving the community's current planning horizon needs would likely cost in excess of $70-million. This does not include any considerations for increased operating costs. Section 7.3.5 discusses operating costs when comparing the various treatment plant alternatives.

As the subject of desalination has been a popular topic, a brief discussion of the pros and cons of the technology, as they relate to water treatment choices for Newport, would be appropriate.

Pro's of Desal:

- There is an abundance of water supplies in terms of seawater and brackish water.
- The capital costs and operating costs for desal are gradually falling as technology seeks to make the process less energy intensive.
- In locations where "fresh" water is simply not available, desal can produce a reliable supply of potable water.

Con's of Desal:

- A significant waste stream is produced that must be properly disposed of.
- High chemical cost to adjust potentially aggressive water resulting from RO.
- High-pressure membranes have correspondingly high energy costs.
- The capital investment for desal equipment is significantly more than conventional treatment alternatives for fresh water supplies.
- The ability to obtain a water right in the ocean is uncertain. Oregon Water Resources has not received or accepted an application to divert seawater for producing potable water.
- The desal system may require significant pretreatment as well as RO treatment. In effect, the system could be equivalent to constructing three separate facilities to accomplish water treatment using sea or brackish water.
- The overall cost of desal is still very high when compared to freshwater alternatives.

Packaged Desal Equipment (RO)

While desal offers tremendous potential in arid regions to provide large volumes of potable water, its application in the northwest is unlikely to gain popularity due to the high costs that are still associated with the technology, especially for smaller communities.

7.3.3 Upgrade Existing Water Treatment Plant with Membrane Equipment

One alternative that has been discussed during the preparation of this Master Plan to provide adequate capacity to meet projected demand and proper treatment to meet present and future treatment regulations is to replace the existing process equipment with membrane treatment equipment at the existing water treatment plant site. The proposed upgrade would include construction of a new addition to the existing treatment plant building with a new clearwell located beneath the addition. The addition would be sized to house all membrane treatment equipment, pumps, cleaning chemicals, and other related equipment. The planned clearwell would be designed to work in conjunction with the existing clearwell to provide adequate disinfection contact time at the 20-year peak design flow. Additional space would be set aside for future expansion of the clearwell to meet long term peak design flows. In addition to the planned building addition, new concrete lined backwash ponds would be constructed northwesterly of the existing treatment plant building in the area currently occupied by the clariflocculators.

Following construction of the proposed addition and membrane treatment equipment installation, the existing treatment plant building could be gutted and refurbished. Planned improvements include new SCADA controls for all phases of water acquisition, treatment, and storage, as well as new laboratory equipment, motor controls and electrical systems, pumps, standby generator, backwash waste basins, and other items.

The planned improvements can be completed while the existing treatment plant continues to treat water. The small footprint of membrane equipment makes continued treatment during construction and installation of needed facilities on the existing site feasible. Upon completion of the proposed upgrades, the existing clariflocculators would be demolished and the proposed concrete lined backwash ponds constructed in their place. The existing backwash pond would be used during construction and until new ponds are complete. Temporary controls for the new membrane equipment may be necessary during construction in order to allow final placement of control equipment within the refurbished portion of the plant.

A conceptual layout of the proposed water treatment plant upgrade is provided in Figure 7.3.3. A cost estimate of the proposed water treatment plant improvements is provided in the table below.

Table 7.3.3a – Water Treatment Plant Upgrade Cost Estimate

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
Big Creek Water Treatment Plant Improvements					
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$1,000,000.00	$1,000,000
2	Demolition	ls	100%	$250,000.00	$250,000
3	New Process Piping	ls	100%	$200,000.00	$200,000
4	Concrete Flatwork	ls	100%	$10,000.00	$10,000
5	Building Foundations	cy	100	$500.00	$50,000
6	Building Addition	sf	4,500	$250.00	$1,125,000
7	Membrane Filtration Equipment	ls	100%	$2,500,000.00	$2,500,000
8	Electrical Improvements	ls	100%	$300,000.00	$300,000
9	Controls and Instrumentation	ls	100%	$200,000.00	$200,000
10	Clearwell Baffling & Modifications	ls	100%	$80,000.00	$80,000
11	Reinforced Concrete Clearwell Expansion	cy	500	$600.00	$300,000
12	New Finished Water Pumps	ea	3	$50,000.00	$150,000
13	Remodel Lab and Office	ls	100%	$150,000.00	$150,000
14	New Parking Area and Road improvements	ls	100%	$50,000.00	$50,000
15	Backup power generation equipment	ls	100%	$200,000.00	$200,000
16	Pretreatment Clarifier - Ballasted Floc system & Raw Water Pumps	ls	100%	$1,250,000.00	$1,250,000
17	Backwash Lagoon Improvements	ls	100%	$400,000.00	$400,000
		Construction Total			$8,215,000
		Contingency (20%)			$1,643,000
		Subtotal			$9,858,000
		Engineering (20%)			$1,971,600
		Administrative costs (3%)			$295,740
		Total Project Costs			**$12,125,340**

In addition to the above water treatment plant improvements, it is recommended that a new raw water transmission pipe be constructed from the upper Big Creek reservoir to the treatment plant site in order to eliminate treatment difficulties associated with water obtained from the lower reservoir during summer months. This will require construction of a new water intake structure within the upper reservoir sized for the City's long term needs in addition to the approximately 4,500 lineal feet of new raw water piping to the existing treatment plant location. Separate cost estimates are provided below for the water intake and raw water transmission piping improvements.

Table 7.3.3b – Water Intake Structure Cost Estimate

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$65,000.00	$65,000.00
2	Concrete anchored Johnson Screen Intake Group	ls	100%	$100,000.00	$100,000.00
3	Anchored piping from intake up and over dam	ls	100%	$100,000.00	$100,000.00
4	Vacuum prime pump system, electrical upgrades, for syphon system	ls	100%	$100,000.00	$100,000.00
5	Compressor, air-burst system for Johnson Screens	ls	100%	$50,000.00	$50,000.00
		Construction Total			$415,000.00
		Contingency (20%)			$83,000.00
		Subtotal			$498,000.00
		Engineering (20%)			$99,600.00
		Administrative costs (3%)			$14,940.00
		Total Project Costs			**$612,540.00**

Table 7.3.3c – Raw Water Transmission Pipe Cost Estimate

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$115,000.00	$115,000.00
2	24" IPS DR17 HDPE Pipe	lf	4,500	$150.00	$675,000.00
3	Fittings and Thrust Restraints & outlet to lower lake	ls	100%	$50,000.00	$50,000.00
		Construction Total			$840,000.00
		Contingency (20%)			$168,000.00
		Subtotal			$1,008,000.00
		Engineering (20%)			$201,600.00
		Administrative costs (3%)			$30,240.00
		Total Project Costs			**$1,239,840.00**

7.3.4 Construct New Water Treatment Plant

Another alternative to satisfy the City's water treatment needs through the planning period and into the future would be to construct a new treatment plant at an alternative site. At this time no alternative site has been identified for complete analysis, although some consideration has been given to locating a new plant near the upper Big Creek dam. The advantage of a treatment plant near the upper dam is that it could take advantage of the superior water quality within the upper reservoir and eliminate the need to construct approximately 4,550 feet of new raw water piping to the existing treatment plant location.

However, these savings would be more than offset by other development costs applicable to a new site including, land acquisition, site clearing and grading, extension of three phase power, construction of finished water piping from the site to the distribution system, roadway improvements, and the like. In addition to these costs, construction of a treatment plant building exceeding the size identified for the proposed addition as well as all equipment, electrical, pump, controls, and other miscellaneous costs would apply to the new site. Based on the understanding that costs of a new water treatment plant at an alternative site would well exceed the costs of upgrading the existing plant, this alternative was not developed further at this time.

7.3.5 Expand Existing Plant with Conventional Equipment

The previous master planning in 1988 showed future plant expansion through the construction of additional clarifier basins and gravity filters added to the existing. Since that time, settlement of one clarifier and filter bay has resulted in concrete cracking and improper function. If the original approach was to be taken now 20-years later, the damaged clarifier and filter would need to be removed and replaced and to accommodate projected flows today the size of the existing clarifier and filters areas would need to be doubled. All existing equipment would also need to be replaced. This creates additional complexity in even flow distribution and difficulties in providing continued treatment during construction. In addition, the major concern with the location of the backwash pump and lack of adequate chlorine contact time would need to be addressed through building expansions. Essentially, due to space constraints at the site, the expense of ensuring continued water treatment during summer construction, and the newer technology common today, expanding the plant in this manner is not economical and is not the prudent choice. This alternative is therefore not considered further.

7.3.6 Comparison of Treatment Alternatives

Three primary alternatives were discussed to address the City's treatment needs within this planning effort. To summarize, the three alternatives considered are:

1. Expand the existing water treatment plant utilizing membrane technology and utilize portions of the existing facility.
2. Construct a new treatment facility (utilizing membranes) on an alternative site, potentially near the upper reservoir.
3. Construct a desalination facility on an alternative site and treat sea or brackish water to produce potable water.

A brief discussion of each major alternative is provided below. An effort was made to discuss the pro's and con's of each alternative and identify any fatal flaws and other information useful in making a decision as to which direction the City should move with regard to water treatment.

Alternative 1: New Plant at Existing Site. This alternative would take advantage of property currently owned by the City. It would also provide some potential for utilizing existing facilities including existing office and storage areas, existing laboratory facilities, existing clearwell volume, and other facilities. The alternative would also allow the new improvements to be constructed while the existing plant provides potable water service to the community.

Pro's of Alternative 1- New Plant at Big Creek:

- Lowest cost
- Utilize existing facilities
- Close to Big Creek water supplies
- City owns property already

Con's of Alternative 1 – New Plant at Big Creek:

- Site has limited unused space
- Some of the site is within a flood plain
- Demolition costs
- Potential seismic code issues when retrofitting existing facilities
- Will need to construct raw water piping from upper reservoir to bypass the lower reservoir

Alternative 2: Construct a new Facility at Alternative Site. This alternative addresses concerns with the Alternative 1 plan. Utilizing an alternative site would allow the existing plant to be abandoned or demolished after the new plant is placed in service. It would also avoid potential seismic code issues related to the existing structure. Potential sites considered included locating the plant near the upper reservoir as well as locating the plant near the two large storage reservoirs.

Pro's of Alternative 2 – New Plant at Alternative Site:

- Avoid potential seismic retrofitting issues
- The City could avoid working in a crowded space on the existing site
- The facility could be fully planned out from "scratch"
- The facility would not have to rely on any existing components

Con's of Alternative 2 – New Plant at Alternative Site:

- City does not own other suitable property – property acquisition costs
- Potentially more piping required to access site
- Potentially higher costs for pumping facilities and power

- Most likely to have a higher development cost than utilizing the existing site and some of the existing components

Alternative 3: Desal. This alternative would address the City's need to expand raw water supplies by utilizing sea or brackish water as a raw water source. The development of this alternative would most likely require the City to obtain property nearer to the source, and construct new facilities for the raw water intake, pretreatment facilities, and RO membranes. Additional considerations would have to be made to deal with the significant waste stream that will be produced from a desal process.

Pro's of Alternative 3 – Desal:

- Potentially limitless supply of raw water
- Potable water quality is high when using RO
- Desal technology is improving and costs are going down

Con's of Alternative 3 – Desal:

- High capital and operating costs when compared to fresh sources
- Significant waste stream disposal issue
- May be difficult to obtain water rights
- Treatment costs greatly impacted by electrical costs

7.3.7 Other Alternatives

In addition to the three primary treatment alternatives discussed above, two other alternatives involving both source water supply and water treatment improvements have been considered in conjunction with the possible future development of Rocky Creek as a municipal water source. The alternatives involving Rocky Creek include either the construction of a dam and transmission system to send additional raw water to the Big Creek site for treatment, or the construction of a dam and water treatment facility at Rocky Creek. In either case, water treatment improvements would need to be completed at the Big Creek site to allow continued use of the current source and provide for the City's short-term water needs. If a water treatment plant were constructed at Rocky Creek, it would allow for smaller capacity improvements to be completed at Big Creek. Neither of these alternatives has been fully developed at this time as the costs associated with construction of a dam and potentially an additionally water treatment plant are expected to be far greater than the other alternatives considered.

The Rocky Creek Dam and facilities have been under consideration for some time, including the option of providing raw or treated water to Newport and possibly other surrounding communities. The project becomes more viable when Lincoln City and other communities are included, resulting in a regional water system improvement project with costs shared among multiple entities. Environmental, political, and technical issues are significant. However, Newport will require additional raw water supplies in the future based on the long term projections developed herein. The City and their neighbors should be vigilant over the coming years to continue working on the development of future water supplies.

7.3.8 Treatment Alternative Cost Comparison

A comparison of capital costs, operating costs, and the potential impact to a typical rate payer is useful when considering these treatment and water supply alternatives. Table 7.3.7 illustrates the comparative costs for each alternative. The following data was utilized for this comparison:

- An analysis of water consumption records suggests that there are approximately 11,269 equivalent dwelling units (EDU's) in the City's water system including all residential, commercial, and industrial water consumption. Normalizing all of the water use in the system to a base equivalent dwelling unit allows analysis and insight into the estimated impact to a typical household customer.
- Operation and maintenance costs estimated from existing budgetary figures for the Big Creek facilities and from industry standards for the desal facilities.

Table 7.3.8 – Treatment Alternative Cost Comparison Summary

Supply/Treatment Option	Big Creek, WTP, 7 MGD	Rocky Creek Dam 7 MGD*	Rocky Creek Dam 10 MGD*	Desalination, 7 MGD
Total estimated project costs	$14,619,780	$60,765,340	$64,078,840	$71,881,200
Total estimated annual operating costs	$120,000	$120,000	$150,000	$3,960,250
Annual payments on a 20 year, 6% interest	$1,274,619	$5,297,799	$5,586,685	$6,266,931
Cost per day comparison (O&M and Capital)	$3,820.87	$14,843.29	$15,716.95	$28,019.67
Cost of water per 1000 gallons	$0.55	$2.12	$2.25	$4.00
Avg. rate increase for 11,269 EDU's	$10.31	$40.06	$42.42	$75.63

* Assumes treatment will be provided at the Big Creek site

Based on the above analysis, the estimated impact to the average rate payer varies from a low of just over $10 per month for the Big Creek Alternative to a high of over $75 per month for implementation of a desal alternative.

Based on a financial analysis, the most cost effective alternative to address the treatment needs is to implement Alternative 1 and expand and upgrade the existing facility at Big Creek. It is worth reiterating that additional reserves will be required before the end of the planning period and the City should diligently work toward a permanent solution. This should include further consideration and discussion regarding the Rocky Creek and Big Creek dams.

7.4 Treated Water Storage Alternatives

7.4.1 Current Deficiencies and Need

Section 4.2.3 discusses storage needs and goals and Section 5.3 describes the existing storage facilities in Newport. Existing total system storage volume is 8.2 million gallons when all tanks are at maximum operating levels. The estimated planning period storage need is coincidently also 8.2 million gallons. Thus from quantity standpoint alone the existing storage volume is adequate for the planning period. However, due to the lack of a significant storage tank at the north end of town, the system is not able to properly deliver fire flows to areas north of NW 66th Street. This deficiency was identified in past planning efforts as well and steps have been taken, including land acquisition and 12-inch piping extensions, to accommodate a future storage tank on NE 71st Street called the "Agate Beach Lower Storage Tank". The tank will be installed in the main pressure zone with a water surface elevation of 275 feet.

To ensure proper delivery of water from this tank to the Agate Beach area and those areas north of 66th Street, additional 12-inch piping is required to tie the proposed tank to the system. As previously stated, 12-inch piping was installed in the past on NE 71st Street in preparation of the Agate Beach Lower Tank.

New 12-inch is needed to connect the tank to the upper end of the existing 12-inch. In addition, new 12-inch is required to connect the lower end of the existing 12-inch on NE 71st Street to the existing 12-inch backbone piping through Agate Beach along Highway 101. The proposed Agate Beach Lower Tank will not replenish properly with water from the treatment plant unless this 12-inch backbone is completed.

Since the 12-inch piping described above is crucial to both water delivery from the tank as well as proper re-filling of the tank, it is included as an integral part of the tank cost. Estimated cost for the Agate Beach Lower Tank and associated connection piping is presented below.

Table 7.4.1 – Agate Beach Lower Storage Tank Cost Estimate

Agate Beach Lower Storage Tank - 1.0 MG GFS					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$180,000.00	$180,000
2	Grading and Site Preparation	ls	100%	$25,000.00	$25,000
3	12-inch piping intertie into system	lf	4,300	$80.00	$344,000
4	Site Piping, Valves, Flow Meter and Vault	ls	100%	$50,000.00	$50,000
5	1.0 MG GFS Bolted Tanks	ls	1	$750,000.00	$750,000
6	Level Sensing and Telemetry	ls	100%	$15,000.00	$15,000
7	Site Fencing	ls	100%	$20,000.00	$20,000
		Construction Total			$1,384,000
		Contingency (20%)			$276,800
		Subtotal			$1,660,800
		Engineering (18%)			$298,950
		Administrative costs (3%)			$49,825
		Total Project Costs			**$2,009,575**

7.4.2 Future Storage Needs

As discussed in Section 5.3.3, the 100-year old concrete Shop tanks will require replacement at some point. Considering the age and condition of the tanks, it is prudent to plan for replacement during this planning period (within the next 20 years). Probable cost data for this project is presented below.

Table 7.4.2a – City Shops Storage Tank Cost Estimate

City Shops Tank Replacement - 1.0 MG GFS					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$155,000.00	$155,000
2	Demolition	ls	100%	$85,000.00	$85,000
3	Grading and Site Preparation	ls	100%	$20,000.00	$20,000
4	Site Piping, Valves, Flow Meter and Vault	ls	100%	$50,000.00	$50,000
5	1.0 MG GFS Bolted Tanks	ls	1	$750,000.00	$750,000
6	Level Sensing and Telemetry	ls	100%	$15,000.00	$15,000
7	Site Fencing	ls	100%	$20,000.00	$20,000
		Construction Total			$1,095,000
		Contingency (20%)			$219,000
		Subtotal			$1,314,000
		Engineering 18%)			$236,520
		Administrative costs (3%)			$6,570
		Land Acquisition			$100,000
		Total Project Costs			**$1,657,090**

Much of the remaining land available for development in the Agate Beach area is higher in elevation than can be served by gravity from the main pressure zone. Currently, service to these areas is provided by the NE 54th St. Booster Pump Station with fire protection dependent on multiple pumps running and grid power supply active. Depending on the rate of development, a storage tank constructed above the main pressure zone with a water surface of 360 to 400 feet should be considered. With completion of the Agate Beach Upper Storage Tank it will be possible to simplify the NE 54th St. BPS to function as a tank fill pump station only. It may also be possible to eliminate the Smith Storage Tank.

Table 7.4.2b – Agate Beach Upper Storage Tank Cost Estimate

Agate Beach Upper Storage Tank - 1.0 MG GFS					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$150,000.00	$150,000
2	Grading and Site Preparation	ls	100%	$20,000.00	$20,000
3	12-inch piping intertie into system	lf	1,560	$80.00	$124,800
4	Site Piping, Valves, Flow Meter and Vault	ls	100%	$50,000.00	$50,000
5	1.0 MG GFS Bolted Tanks	ls	1	$750,000.00	$750,000
6	Level Sensing and Telemetry	ls	100%	$15,000.00	$15,000
7	Site Fencing	ls	100%	$20,000.00	$20,000
		Construction Total			$1,129,800
		Contingency (20%)			$225,960
		Subtotal			$1,355,760
		Engineering (18%)			$244,037
		Administrative costs (3%)			$40,673
		Land Acquisition			$100,000
		Total Project Costs			**$1,740,470**

The need for a second storage tank at the south end of the City will be dictated by development patterns and rates. At this time, much of the south portion of the City is served by the Seal Rock Water District. Much of the south end of town, including the airport, is too high for gravity service from Newport's current facilities. For this planning period such a tank is not needed for hydraulic or for storage volume reasons however significant growth at the extreme southern end of town could change this as could a change in the Seal Rock/Newport service boundary. A site on King Ridge has been identified as the likely location for a southern tank and a cost is presented below.

Table 7.4.2c – King Ridge Storage Tank Cost Estimate

King Ridge Storage Tank - 1.0 MG GFS					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$250,000.00	$250,000
2	Grading and Site Preparation	ls	100%	$20,000.00	$20,000
3	12-inch piping intertie into system	lf	8,000	$80.00	$640,000
4	Site Piping, Valves, Flow Meter and Vault	ls	100%	$50,000.00	$50,000
5	1.0 MG GFS Bolted Tanks	ls	1	$750,000.00	$750,000
6	Level Sensing and Telemetry	ls	100%	$15,000.00	$15,000
7	Site Fencing	ls	100%	$20,000.00	$20,000
		Construction Total			$1,745,000
		Contingency (20%)			$349,000
		Subtotal			$2,094,000
		Engineering (18%)			$376,920
		Administrative costs (3%)			$62,820
		Land Acquisition			$100,000
		Total Project Costs			**$2,533,740**

7.5 Distribution Alternatives

7.5.1 Analysis and Deficiencies

The water distribution system piping and storage network was analyzed using WaterCAD V8. Spatial layout of piping was imported from the AutoCAD base maps developed from aerial photographs and GIS shape files. Elevation data for pipe nodes was taken from topographical data developed by others through aerial photogrammetric methods. The system was analyzed for existing and future conditions to determine where deficiencies exist as well as the optimal correction alternatives. Criteria for determining system problems include the need to accommodate peak hourly flows while maintaining near normal pressures, and the need to provide fire flows during maximum day water demands while maintaining at least 20 psi in the system. Section 4.2.4 and 4.2.5 discuss system capacity and fire flow goals.

Deficiencies in pipe capacity such as inadequate pipe size and/or lack of sufficient looping create restrictions which prevent proper flow to fire hydrants or excessive pressure drops during peak demands. Additionally, hydrant spacing can be too great leading to lengthy hose pulls to reach buildings. Figures 5.5-2a through 5.5-2c show existing hydrant spacing and identify areas where additional hydrants may be added over time to cover gaps. Such minor projects which merely require adding a fire hydrant to existing piping are not detailed in this Plan. Areas where significant fire flow deficiencies exist and improvements are needed include:

1) All areas of the City north of NW 66th Street
2) Bottleneck area between NE 36th Street and Circle Way, including Golf Course Drive
3) All areas along Hwy. 101 south of South Beach State Park
4) All of the Idaho Point Area
5) Lakewood Area
6) Various minor areas where small pipe (less than 6”) exists and hydrants are needed

A system map showing general fire flow/capacity problem areas is presented in Figure 7.5. Other water distribution system issues include:

1) Only single Bay crossing pipe
2) Suspected leakage in 8-inch along Hwy. 101 in wetland area north of SE 62nd St.
3) Poor water turn-over and slow filling in South Beach Tank
4) Aging pump stations

7.5.2 Piping Improvements - South

To correct the fire flow deficiencies at the south end of the Newport water system, to facilitate delivery of water to and from the South Beach Tank, and to eliminate significant leakage in the piping along the wetland area north of SE 62nd St. and south of SE 50th St., additional 12-inch piping is recommended. First, the existing 12-inch piping in South Shore should be connected to the Hwy. 101 8-inch piping by boring or directional drilling and installing a new 12-inch pipe under the Highway. With this connection completed, the existing 8-inch piping through the wetland area can be abandoned. Second, new 12-inch piping should be installed from just north of SE 50th St. to SE 40th St. providing a better connection between the South Beach tank piping and the 12-inch primary looping. The cost for this 12-inch pipe is presented below:

Table 7.5.2-1 – Hwy. 101 SE 40th to 50th and Bore Piping Cost Estimate

Highway 101 SE 40th to 50th Waterline, Hwy. Bore Crossing					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$40,000.00	$40,000
2	2" Waterline extensions	lf	300	$38.00	$11,400
3	12-inch Waterline	lf	2900	$80.00	$232,000
4	12-inch Directional Drill Waterline	lf	125	$300.00	$37,500
5	Fire Hydrant Assemblies	ea	4	$3,000.00	$12,000
6	Fittings and appurtenances	ls	100%	$25,000.00	$25,000
		Construction Total			$357,900
		Contingency (20%)			$71,580
		Subtotal			$429,480
		Engineering (20%)			$85,896
		Administrative costs (3%)			$12,884
		Total Project Costs			**$528,260**

To eliminate a dead-end pipe and correct a fire flow deficiency the 2-inch piping on SW Coho St. should be replaced with new 8-inch from SW 27th to SW 29th.

Table 7.5.2-2 – SW Coho Piping Cost Estimate

SW Coho Street (27th to 29th) Waterline Replacement					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$10,000.00	$10,000
2	8-inch Waterline	lf	700	$80.00	$56,000
3	Fittings and appurtenances	ls	100%	$6,000.00	$6,000
		Construction Total			$72,000
		Contingency (20%)			$14,400
		Subtotal			$86,400
		Engineering (20%)			$17,280
		Administrative costs (3%)			$2,590
		Total Project Costs			**$106,270**

7.5.3 Piping Improvements – Bay Crossing

A significant system vulnerability is the single 12-inch ductile iron bay-crossing pipe installed in 1973 which conveys water to all areas south of Yaquina Bay. A failure of this line could not be repaired quickly and would leave the entire area south of the Bay with only the storage in the South Beach Tank. Most of the developed bay front with steep terrain immediately behind Bay Boulevard is not conducive to bore pit construction. Likely areas for feasible construction occur east of Vista Drive with a crossing beginning at the point of land holding the LNG tank. Likely termination locations are near the Hatfield Marine Science Center or Idaho Point.

Two locations have been considered for potential horizontal directional drilling installation of a new redundant Bay crossing pipe. The first option begins at McLean Point, roughly parallels the existing bay crossing waterline, and terminates near the Hatfield Marine Science Center (HMSC). The second option begins near the LNG tank and ends at Idaho Point. The Idaho Point option involves more piping in order to connect to the existing system.

Table 7.5.3-1 – Bay Crossing, HMSC Option Cost Estimate

12" Redundant Bay Crossing, HMSC Option					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$100,000.00	$100,000
2	Ingress and egress pits and accommodations	ls	100%	$90,000.00	$90,000
3	12-inch directional drill installed HDPE	lf	2400	$300.00	$720,000
4	12-inch Waterline	lf	1000	$80.00	$80,000
5	PRV Station	ls	100%	$65,000.00	$65,000
6	Fittings and appurtenances	ls	100%	$30,000.00	$30,000
7	Surface restoration and misc. civil	ls	100%	$40,000.00	$40,000
		Construction Total			$1,125,000
		Contingency (20%)			$225,000
		Subtotal			$1,350,000
		Engineering (20%)			$270,000
		Administrative costs (3%)			$40,504
		Total Project Costs			**$1,660,504**

Table 7.5.3-2 – Bay Crossing, Idaho Point Option Cost Estimate

12" Redundant Bay Crossing, Idaho Point Option					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$140,000.00	$140,000
2	Ingress and egress pits and accommodations	ls	100%	$40,000.00	$40,000
3	12-inch directional drill installed HDPE	lf	2900	$300.00	$870,000
4	12-inch Waterline	lf	4700	$80.00	$376,000
5	PRV Station	ls	100%	$65,000.00	$65,000
6	Fittings and appurtenances	ls	100%	$40,000.00	$40,000
7	Surface restoration and misc. civil	ls	100%	$50,000.00	$50,000
		Construction Total			$1,581,000
		Contingency (20%)			$316,200
		Subtotal			$1,897,200
		Engineering (20%)			$379,440
		Administrative costs (3%)			$56,920
		Total Project Costs			**$2,333,560**

7.5.4 Piping Improvements – Idaho Point

The Idaho Point area is supplied with a long run (4000 feet) of single 6-inch piping and piping along the streets is too small to allow fire flows. In addition, pressures at the highest areas of the Point are marginal when served by the South Beach Tank. Service is being improved with connection to the OCCC booster pump station however fire protection will still not be available due to the undersized piping. Gravity service to the Point appears feasible if the redundant bay crossing to the Point is constructed. Regardless of how water supply reaches Idaho Point, replacement of the undersized piping at the end of the Point is required to allow fire flows. The cost to install an 8-inch loop at the Point to replace the existing 2- and 4-inch pipe is presented below.

Table 7.5.4-1 – Idaho Point Piping Cost Estimate

Idaho Point Waterline Replacement and Looping					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$40,000.00	$40,000
2	8-inch Waterline	lf	4530	$70.00	$317,100
3	Fire Hydrant Assemblies	ea	4	$3,000.00	$12,000
4	Fittings and Appurtenances	ls	100%	$20,000.00	$20,000
		Construction Total			$389,100
		Contingency (20%)			$77,820
		Subtotal			$466,920
		Engineering (20%)			$93,385
		Administrative costs (3%)			$14,010
		Total Project Costs			**$574,315**

If the Idaho Point redundant bay crossing pipe option is constructed, the 4000 feet of undersized 6-inch piping currently feeding Idaho Point could be abandoned. If the less expensive HMSC bay crossing option was constructed, this 4000 feet of pipe would need to be replaced with 12-inch to allow fire flows from the OCCC pump station; bringing the total cost to around that of the more expensive Idaho Point bay crossing option.

7.5.5 Piping Improvements - North

The proposed Agate Beach Lower Storage Tank and associated connecting piping corrects almost all fire protection problems in the City north of NW 66th Street with the exception of fire flows along the northernmost section of 6-inch along Highway 101. To correct this deficiency and to eliminate a dead-end pipe run, an 8-inch pipe is proposed to connect the end of NE Avery St. to the 6-inch on Hwy. 101.

Table 7.5.5-1 – NE Avery Street Loop Closure Cost Estimate

NE Avery Street Loop Closure					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$8,000.00	$8,000
2	8-inch Waterline	lf	370	$70.00	$25,900
3	8-inch Directional Drill Waterline	lf	120	$300.00	$36,000
4	Fittings and appurtenances	ls	100%	$6,500.00	$6,500
		Construction Total			$76,400
		Contingency (20%)			$15,280
		Subtotal			$91,680
		Engineering (20%)			$18,340
		Administrative costs (3%)			$2,750
		Total Project Costs			**$112,770**

Adequate fire flows are not available along Golf Course Drive and along the east side of Highway 101 from NE 36th Street to Circle Way. Existing 12-inch piping connecting to the main core, the treatment plant, and main storage tanks extends northward but stops at 36th Street. 12-inch backbone piping along the Highway is also available at Circle Way but the connection in between these two 12-inch pipes has not yet been completed creating a bottleneck in capacity. The 4-inch piping on Golf Course Drive is also inadequate for conveying even minimum fire flows.

To remedy this problem area, the 12-inch piping should be extended from NE 36th to 40th Street where new 8-inch can be connected and then installed to replace the existing 4-inch along Golf Course Drive. Between NE 40th and Circle Way, the existing 4-inch piping along the east side of the Highway should be replaced with 12-inch to complete the backbone and provide fire flows without the need to pull fire hose across the Highway.

Table 7.5.5-2 – Highway 101, NE 36th to NE 40th Waterline Cost Estimate

Highway 101 NE 36th to NE 40th Waterline					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$20,000.00	$20,000
2	12-inch Waterline	lf	1400	$80.00	$112,000
3	Fire Hydrant Assemblies	ea	3	$3,000.00	$9,000
4	Fittings and appurtenances	ls	100%	$14,000.00	$14,000
		Construction Total			$155,000
		Contingency (20%)			$31,000
		Subtotal			$186,000
		Engineering (20%)			$37,200
		Administrative costs (3%)			$5,580
		Total Project Costs			**$228,780**

Table 7.5.5-3 – Golf Course Drive Waterline Cost Estimate

NE 40th and Golf Course Drive Waterline Replacement					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$25,000.00	$25,000
2	8-inch Waterline	lf	2800	$70.00	$196,000
3	Fire Hydrant Assemblies	ea	6	$3,000.00	$18,000
4	Fittings and appurtenances	ls	100%	$25,000.00	$25,000
		Construction Total			$264,000
		Contingency (20%)			$52,800
		Subtotal			$316,800
		Engineering (20%)			$63,360
		Administrative costs (3%)			$9,510
		Total Project Costs			**$389,670**

Table 7.5.5-4 – Highway 101, NE 40th to Circle Way Waterline Cost Estimate

Highway 101 NE 40th to Circle Way Waterline Replacement					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$35,000.00	$35,000
2	12-inch Waterline	lf	3400	$80.00	$272,000
3	Fire Hydrant Assemblies	ea	4	$3,000.00	$12,000
4	Fittings and appurtenances	ls	100%	$26,000.00	$26,000
		Construction Total			$345,000
		Contingency (20%)			$69,000
		Subtotal			$414,000
		Engineering (20%)			$82,800
		Administrative costs (3%)			$12,420
		Total Project Costs			**$509,220**

The existing 6-inch on Crestview Place has insufficient capacity to convey adequate fire flow to the hydrant near the cul-de-sac. In addition, the 2-inch and 4-inch piping on 17th Court is undersized. To correct the fire flow problem and eliminate two dead-end pipe runs, it is recommended that new piping be installed on 17th Court connecting to the end of the existing 6-inch on Crestview Place.

Table 7.5.5-5 –Crestview Place to 17th Court Waterline Cost Estimate

NE Crestview Pl. to 17th Ct. Waterline Loop					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$9,000.00	$9,000
2	8-inch Waterline	lf	1000	$70.00	$70,000
3	Fire Hydrant Assemblies	ea	2	$3,000.00	$6,000
4	Fittings and appurtenances	ls	100%	$5,000.00	$5,000
		Construction Total			$90,000
		Contingency (20%)			$18,000
		Subtotal			$108,000
		Engineering (20%)			$21,600
		Administrative costs (3%)			$3,240
		Total Project Costs			**$132,840**

Significant sections of undersized 2-inch piping on NW 19th Street between Highway 101 and Nye Street and on NW Nye Street between NW 18th and 20th create an area where hydrants cannot be installed and fire flows are not available. It is recommended that this 2-inch piping be replaced and several fire hydrants installed.

Table 7.5.5-6 – NW 19th and Nye Street Waterline Cost Estimate

NW 19th (Nye St. to Hwy 101) and Nye St. (18th to 20th) Waterline					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$10,000.00	$10,000
2	8-inch Waterline	lf	1000	$70.00	$70,000
3	Fire Hydrant Assemblies	ea	3	$3,000.00	$9,000
4	Fittings and appurtenances	ls	100%	$15,000.00	$15,000
		Construction Total			$104,000
		Contingency (20%)			$20,800
		Subtotal			$124,800
		Engineering (20%)			$24,960
		Administrative costs (3%)			$3,750
		Total Project Costs			**$153,510**

A long section of 2-inch pipe on NW Ocean View between NW 12th and NW 14th prevents fire flows in this area. In addition, three 2-inch dead-end pipe runs occur in this block. Replacing the 2-inch on Ocean View is recommended as well as replacing the connecting 2-inch on NW 13th and NW Lake Streets. This will solve the area fire flow problems and will eliminate three dead-end pipe runs.

Table 7.5.5-7 – NW Ocean View Waterline Cost Estimate

Ocean View (12th to 14th) Waterline Replacement, Loop 13th to 12th					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$13,000.00	$13,000
2	8-inch Waterline	lf	1470	$70.00	$102,900
3	Fire Hydrant Assemblies	ea	3	$3,000.00	$9,000
4	Fittings and appurtenances	ls	100%	$8,000.00	$8,000
		Construction Total			$132,900
		Contingency (20%)			$26,580
		Subtotal			$159,480
		Engineering (20%)			$31,896
		Administrative costs (3%)			$4,784
		Total Project Costs			**$196,160**

A fire hydrant is needed at the intersection of NE Douglas and NE 5th Streets. This will require the replacement of the undersized 2-inch piping on NE 5th between Benton and Eads. Alternatively, the existing 4-inch piping on NE Douglas between NE 4th and 6th Streets could be replaced.

Table 7.5.5-8 – NW 5th, Benton to Eads Waterline Cost Estimate

NE 5th St., Benton to Eads					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$7,500.00	$7,500
2	8-inch Waterline	lf	820	$70.00	$57,400
3	Fire Hydrant Assemblies	ea	1	$3,000.00	$3,000
4	Fittings and appurtenances	ls	100%	$5,000.00	$5,000
		Construction Total			$72,900
		Contingency (20%)			$14,580
		Subtotal			$87,480
		Engineering (20%)			$17,496
		Administrative costs (3%)			$2,624
		Total Project Costs			**$107,600**

7.6 Distribution Pump Station Alternatives

7.6.1 Lakewood Pump Station

The Lakewood BPS contains two 10-Hp pumps which were relocated from an abandoned pump station. The pumps are at the end of their expected service life and are too small to provide fire protection in the service area. The Lakewood BPS should be replaced during the planning period with equipment designed to provide normal service to 50 lots and to provide fire flows. Discharge pressure should be reduced. A site with sufficient elevation to locate a storage tank is not available so fire flows must be provided with pumping equipment only. Either a diesel powered fire pump or an electric pump with a standby generator should be considered. Modern variable frequency drives can be utilized to eliminate the need for the large steel pressure tank at the top of the subdivision.

Table 7.6.1 – Lakewood Pump Station Cost Estimate

Lakewood Pump Station Rehabilitation					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$15,000.00	$15,000
2	Pumps and Drives	ls	1	$30,000.00	$30,000
3	Mechanical and Electrical Improvements	ls	All	$25,000.00	$25,000
4	Fire Pump	ls	1	$45,000.00	$45,000
5	Telemetry Upgrades	ls	All	$12,000.00	$12,000
		Construction Total			$127,000
		Contingency (20%)			$25,400
		Subtotal			$152,400
		Engineering (20%)			$30,480
		Administrative costs (3%)			$4,570
		Total Project Costs			**$187,450**

7.6.2 Candletree Pump Station

The Candletree PS is in fair condition but is inefficient and becoming antiquated. Refurbishment of the 20-year old PS should occur during the planning period. New pumping equipment can be placed inside the existing building however it will be necessary to maintain service during installation. It is likely that pumps matching the larger pumps in the newer Yaquina Heights BPS will adequately serve 20-year development of the Candletree PS service area.

Table 7.6.2 – Candletree Pump Station Cost Estimate

Candletree Pump Station Rehabilitation					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, and Mobilization Costs	ls	100%	$18,000.00	$18,000
2	Pumps and Drives	ls	1	$75,000.00	$75,000
3	Mechanical and Electrical Improvements	ls	All	$35,000.00	$35,000
4	Telemetry Upgrades	ls	All	$12,000.00	$12,000
		Construction Total			$140,000
		Contingency (20%)			$28,000
		Subtotal			$168,000
		Engineering (20%)			$33,600
		Administrative costs (3%)			$5,040
		Total Project Costs			**$206,640**