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City of Dundee
Recycled Water
Feasibility Study

27 June 2013

Prepared for

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K/J Project No. 0991005*30

Recycled Water Feasibility Study

City of Dundee

27 June 2013

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List of Acronyms

$/gallon	dollars per gallon
%	percent
AACE	American Association of Cost Engineers
ADD	Average Daily Demand
City	City of Dundee
DEQ	Department of Environmental Quality
ENR	Engineering News Record
ERU	equivalent residential unit
fps	feet per second
FTE	Full Time Employee
GIS	Geographic Information System
gpd	gallons per day
gpm	Gallons per minute
HDPE	high-density polyethylene
HP	horsepower
Kennedy/Jenks	Kennedy/Jenks Consultants, Inc.

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kW	kilowatt
kWh	Kilowatt-hour
MDD	Maximum Daily Demand
mg/L	milligram per liter
MGD	million gallons per day
mJ/cm2	millijoules per centimeter squared
NPW	Net Present Worth
O&M	Operations and Maintenance
ODOT	Oregon Department of Transportation
OHA	Oregon Health Authority
ORS	Oregon Revised Statute
PRV	pressure reducing valves
psi	Pounds per square inch
PVC	Polyvinyl chloride
RM	river mile
Study	Recycled Water Feasibility Study
UV	ultraviolet
UW	Utility Water
WWTP	Wastewater treatment plant
WRCC	Western Regional Climate Center

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Executive Summary

Introduction and Basis for Study

The City of Dundee (City), located in Yamhill County, provides residential and commercial domestic water supply to approximately 3,356 customers through a total of nine water production wells and the various pump stations, water storage reservoirs, and distribution mains typical of water supply systems. The current system capacity is near capacity and relatively unable to accommodate additional service connections. Because of this, the City is faced with limited growth potential without installing significant capacity improvements.

While recent growth has slowed, the City is poised to develop, primarily to the east where existing farmland within City Limits has been targeted in the City's Riverside District Master plan. This area encompasses over 360 acres and is projected to include development of approximately 1255 equivalent residential units (ERUs). Development in this area, however, will trigger the need to increase capacity to the domestic water supply.

While adding well capacity or a surface water intake and treatment plant on the Willamette River are possible solutions, this Recycled Water Feasibility Study (Study) investigates the feasibility of another option; using recycled water produced at the City's wastewater treatment plant to develop and provide a recycled water utility. This utility would be an incentivized alternative available to customers to reduce their potable water demands, namely irrigation demands. If current and future projected potable water demands could be collectively reduced, the City could potentially delay or offset completely the potable water system improvements. Additionally, a recycled water program offers many secondary benefits including, decreasing local aquifer stress, incorporating an earth conscience recycled component to the local water cycle, and aligns with City ethos to be good stewards of the land.

The City of Dundee and the Oregon Water Resources Department have jointly funded this Recycled Water Feasibility Study to investigate the service areas and demands available within the City of Dundee. This Study presents the projected water supply demands, identifies the potential recycled water customers and related demands, and provides a feasibility analysis related to the findings. Once complete, it is anticipated that this Study will provide the framework for City Council to engage citizens in discussions about potential opportunities for the City to develop a recycled water utility.

Purpose and Scope

The purpose of the Study is to explore the feasibility of the City developing and operating a recycled water distribution system inside the City limits using water treated at the City's wastewater treatment plant. The scope of the Study is to identify the long term drinking water supply issues, identify potential recycled water users, the ability to decrease seasonal potable water demands through the use of the recycled water system, develop preliminary recycled water distribution alignments, estimate capital, operations, and maintenance costs over a 20-year lifecycle, and provide a recommended plan forward based on the feasibility analysis completed.

Feasibility Defined

Project feasibility for this Study has been defined as the ability to implement a recycled water system that would offset improvements to the water supply system necessary to accommodate future growth.

The methodology for the feasibility determination is the following:

1. Establish current potable water usage and estimate breakdown of usage types to project future development demands.
2. Identify list of potential recycled water customers and estimate potential recycled water demands.
3. Define future development water system demands and proportion related to irrigation and other demands, such as toilet flushing, that could be served by recycled water.
4. Estimate the reduction in potable water demands associated with using recycled water in lieu of potable water for allowable uses.
5. Develop preliminary distribution system for serving potential recycled water customers.
6. Estimate capital cost estimate and annual operating cost estimate for distribution system.
7. Determine feasibility through following equations:

   Project is Feasible (Positive):
   Total Water Demand – Recycle Water Demand – Other Consumption Reductions < Future Potable Water Supply

   Project is not Feasible (Negative):
   Total Water Demand – Recycle Water Demand – Other Consumption Reductions > Future Potable Water Supply

Long Term Drinking Water Supply

The City's current potable water system relies on a total of nine domestic groundwater wells with a cumulative capacity of approximately 0.94 million gallons per day (MGD). In addition to this current capacity, the City is in the process of obtaining water rights for the 2005 test well which was recently determined to have an estimated production capacity of 125 gpm to 175 gpm. This additional capacity threshold is also shown on the capacity charts presented.

On an average service day, current capacity is well above the average demand. While variations occur across the months, the average daily demand is between 300,000 and 400,000 gallons per day (0.3-0.4 MGD). During summer months, however, irrigation drives the demand to near peak supply capacity. During the 2012 summer months, this maximum day demand reached 0.84 MGD. However, the average of the previous seven years maximum day demands is 0.90 MGD, indicating 2012 may have been a low demand year. A summary of the average daily and maximum daily demands is provided below in Figure ES.1.

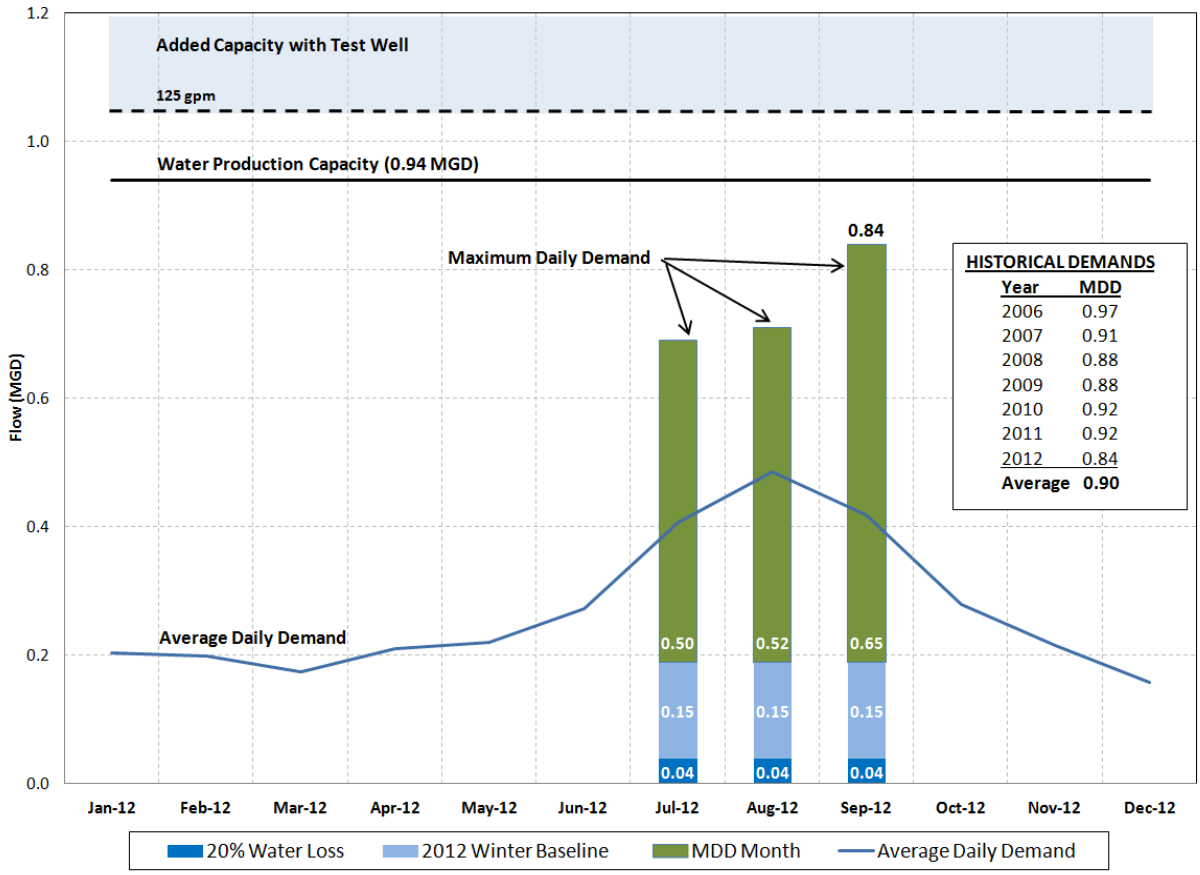


Figure ES.1: Average and Maximum Daily Demands, 2012

Since a maximum day demand is the design basis for system supply, during these peak summer periods, the City's supply is essentially at capacity.

Projected Demands

Water demands generated from 2012 metered data were used to develop water demand projections by connection type and number. Winter baseline demand, summer peak demand, toilet flushing demand, and irrigation demand unit factors were then developed for each of the connection types. Unit flow factors were then adjusted to reflect the lower than average demand year of 2012. These adjusted unit factors were then coupled with growth projected within the Riverside Masterplan area to project future potable water demands. The resulting flow projections, summarized by Figure ES.2, shows existing capacity is unable to support the anticipated demands. In order to serve this growth, the City would need to add approximately 0.82 MGD to the existing domestic water capacity.

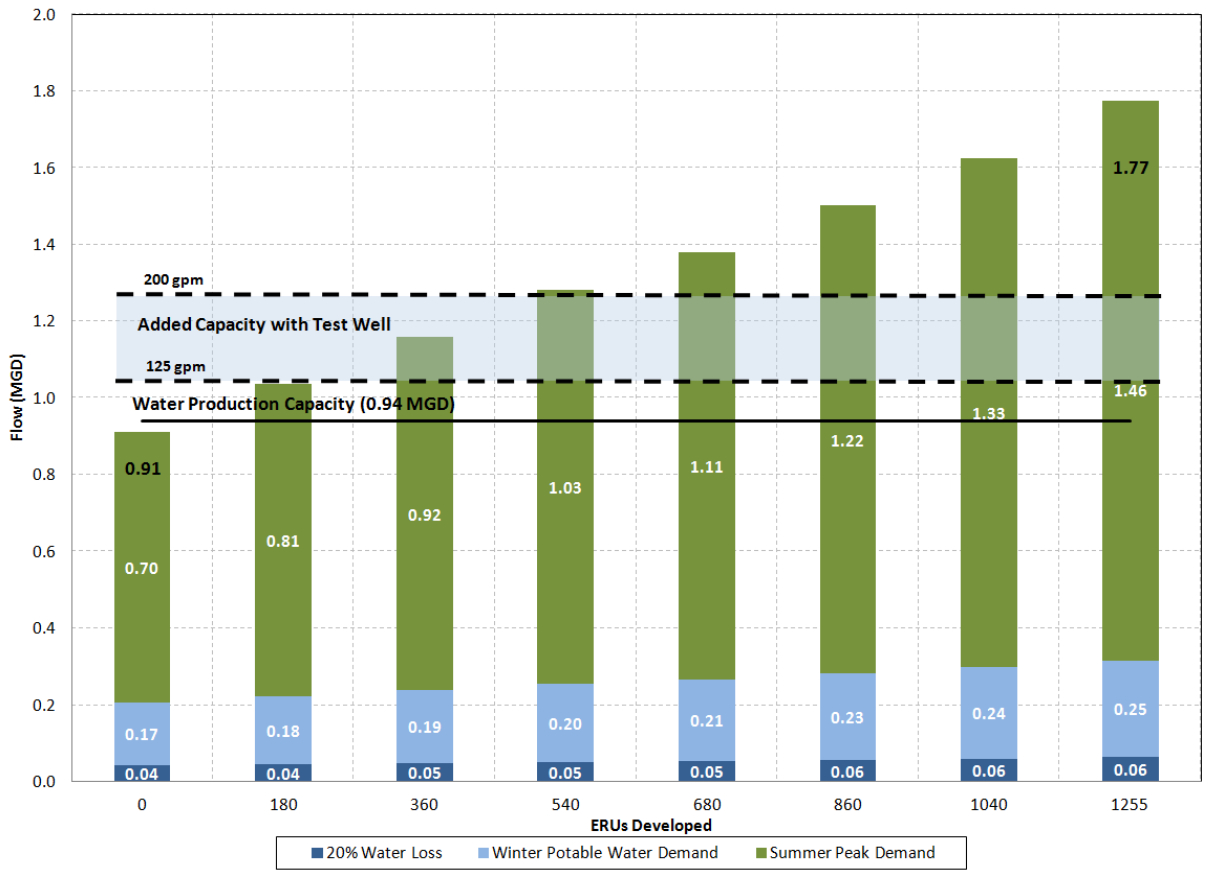


Figure ES.2: Projected Water Demands

Definitions:
Winter Baseline Demand: average daily demand January through March
Summer Peak Demand: Maximum Day Demand minus Winter Baseline

While traditionally the City has added capacity through groundwater wells, the City also holds surface water rights on the Willamette River and could opt to construct a new intake and treatment plant. Or, per the scope of this Study, the City may be able to offset demands by relying on recycled water for irrigation purposes, decreasing or eliminating potable water capacity improvements.

Existing Recycled Water Capacity

The City is currently a producer of Class A quality recycled water, the highest classification of treated wastewater having the most Oregon Department of Environmental Quality approved allowable uses. The recent improvements at the City's wastewater treatment plant included production capacity of this Class A quality recycled water. This process includes ultraviolet disinfection, a storage reservoir, and supply pumps to serve washdown and irrigation needs

across the plant property. The current installed capacity of the pumping system is 220 gallons per minute (gpm) (0.32 MGD) and the ultraviolet (UV) disinfection capacity is 0.85 MGD.

Identifying Recycled Water Customers and Demands

In order to maximize existing capabilities, recycled water customers and demands must be determined. Identifying these demands and decreasing the domestic water demands is a two-fold approach:

- Target existing high water consumers to decrease current maximum day demands.
- Leverage installation of the infrastructure associated with serving current customers to facilitate future connections, targeting expected growth areas.

This approach allows the City to immediately reduce the maximum day demand stress on their potable water system while developing the utility supply network to serve future developers. While it is difficult and costly to connect existing users, where the demand is great enough and where the City can best leverage the installation to facilitate future connections, the benefits can outweigh the initial costs. Secondly, capturing future development demands is where the City can reduce, potentially significantly, the water capacity improvements otherwise required.

This filtering methodology resulted in identifying four current customer target areas to be considered for this feasibility study:

- **Area 1:** Wastewater Treatment Plant (WWTP)
- **Area 2:** Dundee Billick School and Park
- **Area 3:** Other In-City properties
- **Area 4:** Riverside

Recycled water demands at these locations were then developed from agronomic irrigation rates to estimate potential recycled water flows and the reduction impact to current potable system capacity, summarized in Figure ES. 3.

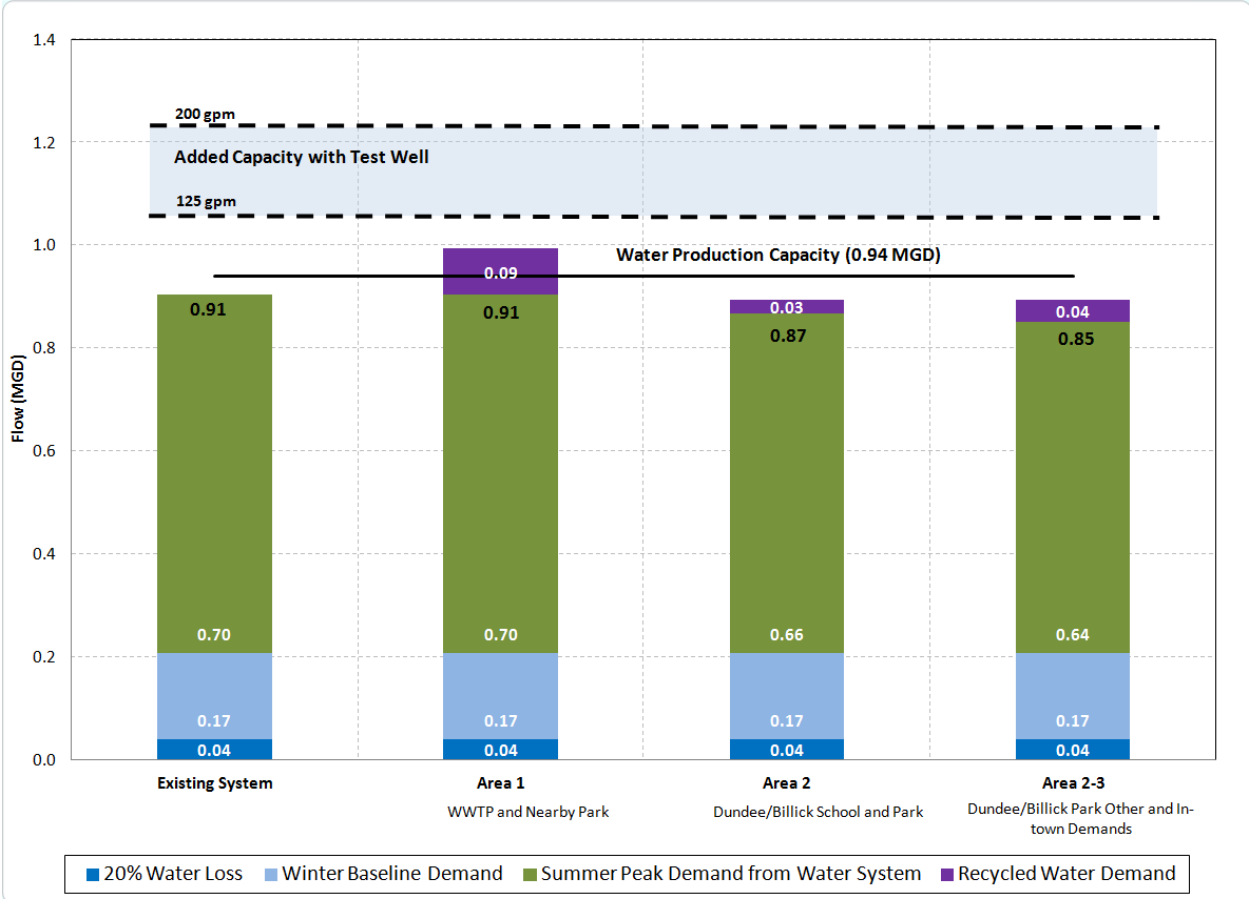


Figure ES.3: Recycled Water Service Area Demand Summary

The irrigation demand tables presented above indicate the greatest current water demands are in Areas 1 and 2, WWTP and Dundee Billick School and Park. Smaller parks and individual metered lots currently consuming elevated irrigation rates, Area 3, are relatively low impact services.

Summary of Recycled Water Service Areas

All areas considered were shown to have water demands serviceable by recycled water; however, due to the significant installation costs and relatively small recycled water demands estimated at Area 3, the implementation of the recycled water program should initially focus on serving Areas 1 and 2, the WWTP and Dundee/Billick School and Park, followed by developer connections. Future connections serving the Area 3 users should be considered as a long term potential.

Distribution System and Costs

Distribution piping alignments and installation costs for each of the proposed service areas was developed based on maintaining 3-feet minimum cover, 5-feet horizontal and 18-inch vertical separation from existing potable water pipelines, and abiding by Oregon Revised Statute (ORS) requirements at all crossing locations. Conceptual level construction costs for each alignment were then developed and are summarized below in Table ES.1.

Table ES.1: City of Dundee Potential Recycled Water System Alignment

Area	Max Day Demand Flow (gpd)	Lineal Feet of Pipe 6-inch	Lineal Feet of Pipe 8-inch	Estimated Cost	Comments
1: WWTP	90,000		350	$48,000	Onsite Pipe to NTS
2: Dundee/Billick Park	35,600		7,000	$710,000	Edwards to 5th
3A: Fortune Park	5,050	775		$80,000	5th to 8th via Maple
3B: Hwy 99 Properties	6,940	650		$130,000	South on Hwy 99
3C: Falcon Crest Park	5,210		5,300	$510,000	Parks to Alder
4: Riverside Development	<450,000				Unknown Lengths – Developer Defined

Note:
a) Does not include onsite storage or pumping costs. See Section 5

Serviceable Recycled Water Range

Actualized flows and demands offset by the recycled water program are a function of many factors, including political decision-making at a City Council level, effectiveness of outreach and educational programs, and overall buy-in from citizens. Because of these difficult to quantify factors, a range of recycled water demands that may be actually realized are presented below, represented by the purple shaded region. The potable water demands are represented by the blue and green segments.

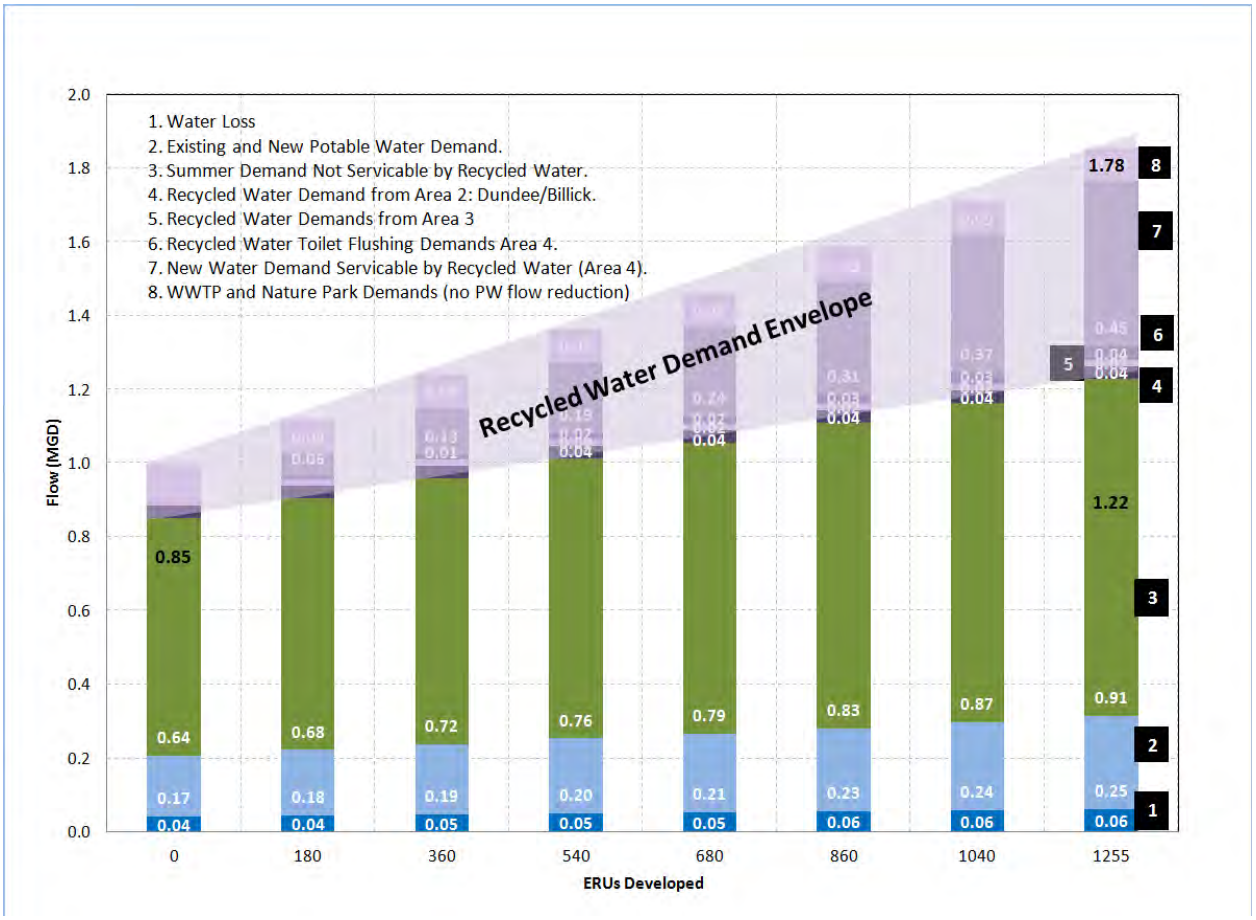


Figure ES.4: Recycled Water Service Area Demand Summary

The Dundee Water Supply Portfolio

Implementation of the recycled water program can help reduce water supply issues as evident by Figure ES.4; however, the extent that it can eliminate the water supply shortfall permanently would require an aggressive and optimistic implementation of the program. Instead, the recycled water program adds another tool the City can utilize to address and manage the overall water supply issue. While the recycled water program can be a major contributor to decreasing the daily demands taxing the domestic water supply, the City should pursue a diversified 'Water Supply Portfolio' strategy, implementing other tools including conservation, the continued pursuit of lost water, and potentially additional small capacity water supply wells as needed, to decrease the overall reliance on any single supply and provide a comprehensive water supply solution.

Feasibility Analysis

Each of the areas presented were found to have water demands that could be met with recycled water. The extent of these flows that are actually realized will be based on a number of factors which may include the level of City Council support, effectiveness of outreach and educational programs, the rate at which the water is incentivized, and most importantly general overall

customer buy-in. Many of these factors require further discussions with the user base to develop a better understanding of what the market will bear and how the program would be accepted.

For the purposes of the Feasibility Analysis, the median recycled water consumption level was carried through the evaluation. This level estimates 65% of the projected recycled water demands will be realized. In addition to the recycled water program, the other conservation efforts recommended by the 'portfolio' approach were included in the demand projections used for the feasibility analysis and are presented below in Figure ES.5. In this figure, green and blue colors represent demands served by the potable water system, while shades of purple represent recycled water serviceable demands.

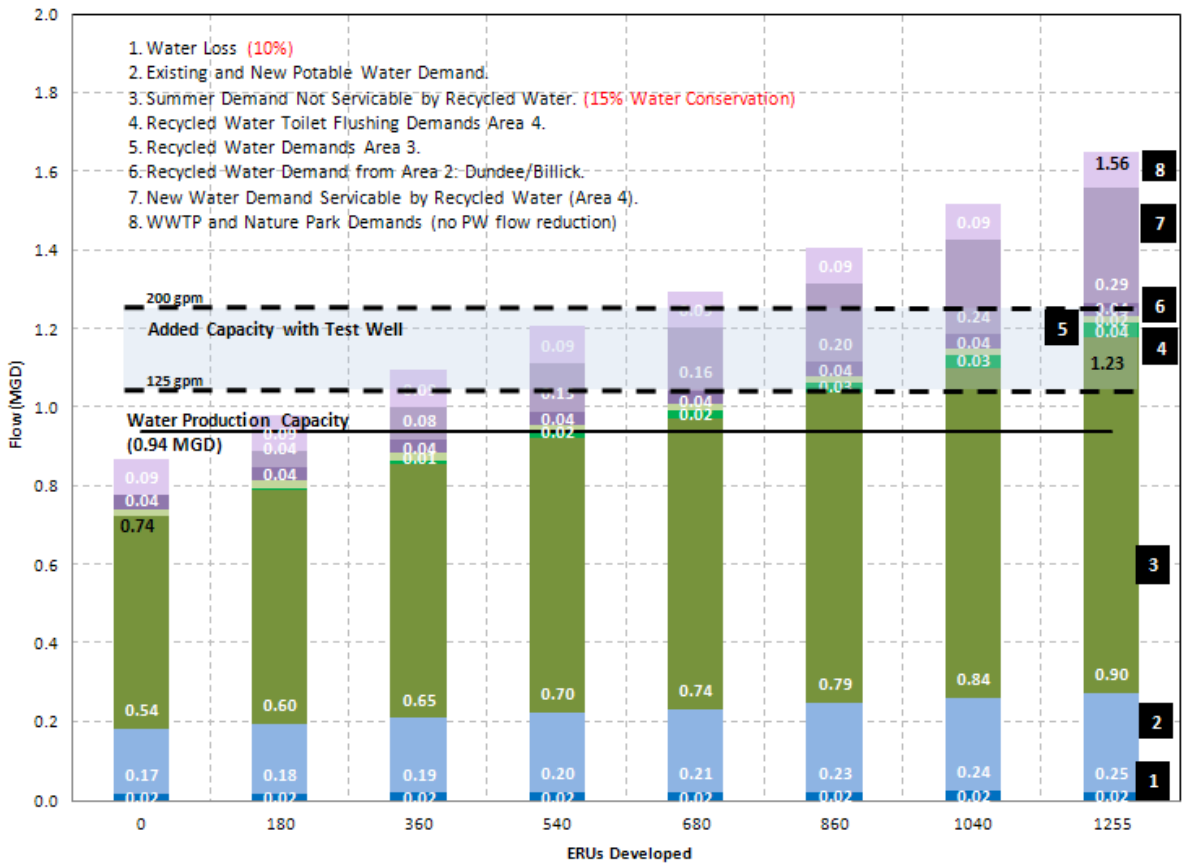


Figure ES.5: Water Demand Projections Incorporating Demand Reduction Portfolio Tools

<u>Summary of Portfolio in Figure ES.5</u>

- Recycled Water demands are assumed at 65% irrigation demands across developed areas.
- Recycled water service included to Dundee/Billick School and Park.
- No recycled water service to Area 3.
- No recycled water service for toilet flushing in new developments.

- Water conservation reduces potable demands by 15%
- Reduced water loss to 10%

This portfolio approach incorporates the recycled water program, assuming a medium usage scenario, includes a 15% conservation effort to reduce current and projected potable demands, and includes continued leakage repairs to reduce the lost water to a more acceptable 10% threshold. With Feasibility defined as the ability to decrease and, therefore, postpone installation of potable water capacity improvements, the feasibility equation was applied against the Portfolio scenario presented above, the results of which are provided below in Table ES.2.

Table ES.2: Feasibility Analysis

New ERUs	Total Water Demand (MGD)	Recycled Water Demand (MGD)	Other Consumption Reductions (MGD)	Total Water Demand – RW Demand-Other Consumption (MGD)	Future Water Supply Capacity (MGD)	Feasibility Threshold
0	0.90	0.04	0.12	0.74	1.23	Positive
180	1.03	0.08	0.14	0.81	1.23	Positive
360	1.15	0.12	0.15	0.88	1.23	Positive
540	1.27	0.16	0.16	0.95	1.23	Positive
680	1.37	0.19	0.17	1.01	1.23	Positive
860	1.49	0.23	0.18	1.08	1.23	Positive
1040	1.62	0.28	0.19	1.15	1.23	Positive
1255	1.76	0.33	0.21	1.23	1.23	Positive

As shown, with the range of additional water production at the test well, the medium usage scenario coupled with incorporating the water system portfolio approach can result in extending the potable water supply to serve the estimated 1255 additional ERUs.

Cost Analysis

Many currently undefined factors will contribute to the allowable utility rate, including an estimation of the expected timing of development, the aggressiveness in which the City pursues implementation of the recycled water program, the extent and costs of water supply improvements, and ultimately the user accepted utility rate for the program. In order to better quantify these inputs, continue discussions with end users, and more formally address the tolerable utility rate, a complete rate study is recommended.

Capital costs associated with implementing the recycled water program were presented above. In addition to these fixed costs, annual operations and maintenance costs will be incurred. These include recommended maintenance sinking funds for reservoir recoating, routine pump and pipeline repairs and maintenance.

Net present worth evaluation for the recycled water system including capital and O&M costs was completed using Lifecycle Cost metrics presented in Section 2. The estimated NPW of the system is approximately $3,270,000.

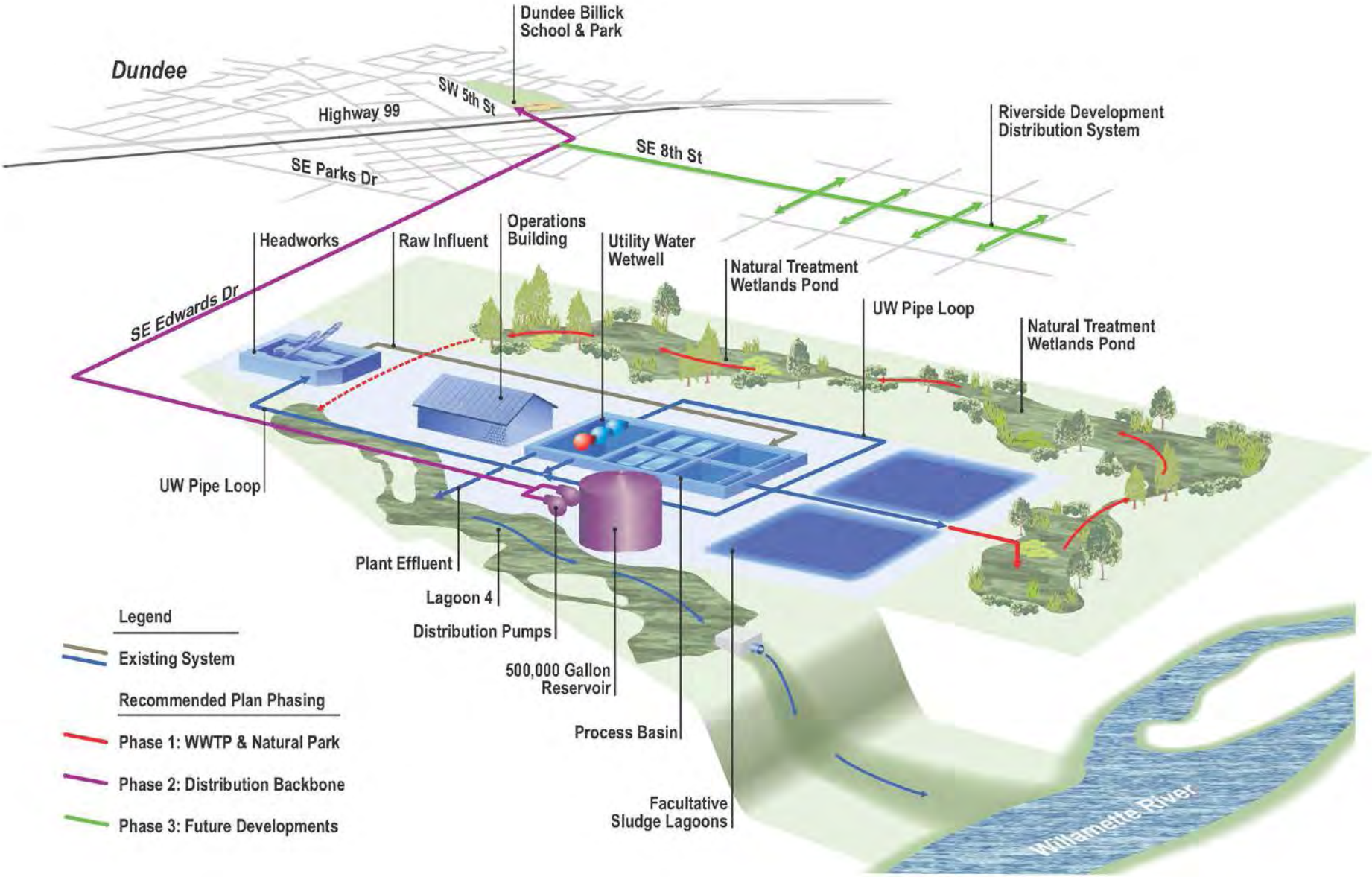


Figure ES.6: The Recommended Plan

Conclusions and Recommendations

The City should be commended for its continued progressive thinking and pursuit of alternative solutions to an all too common city dilemma. Many cities across the state, country, and world face diminishing water supplies and are increasingly turning to non-traditional sources to meet their community needs. The City of Dundee is similar in this regard; however, Dundee is ahead of the curve and is poised to take advantage of their existing recycled water capabilities. This, coupled with the significant growth potential to the east, provides a unique opportunity to implement a potentially very successful recycled water program. Implementation of such a program is not without its hurdles however. Many recycled water programs have been sidelined due to the inability of the potential customer base to accept and buy into the plan. While this Study has shown a positive feasibility for Dundee, much community outreach, education, and most importantly, open dialogue between the City and its customers will be necessary to progress this plan forward from a feasible concept to a tangible solution.

This continued communication between the City and perspective customers will help keep potential customers engaged, develop a user base that can actively assist in defining the program, develop customer buy in and support, and capitalize on the momentum developed through this Study.

Next Steps

- Update the City's Water System Master Plan:
  - Incorporate recycled water flows and demands established in this feasibility study
  - Address service to the Riverside Area; define service pressures, distribution criteria, required fire flow
  - Create hydraulic model to evaluate current and future water distribution system
  - Address high system pressures in the lower distribution system
  - Develop a recommended Capital Improvement Program for existing and future water system including renewal and replacement pipeline projects.
  - Develop financing options, rates, and the necessary system development charges associated with the recycled water utility.
- Begin to consider policy and implementation framework including development of a Recycled Water Utility and the determination of necessary SDCs.
- Create Development Standards and update Public Works Standards to incorporate recycled water details and installation requirements.
- Conduct a formal rate study, including a user survey to help define level of interest throughout the community and a customer acceptable utility rate.
- Continue to pursue additional potential customers. Other recycled water demands may be available throughout the City. Typically, as these types of programs are developed, more users and demands can be categorized.

- Implement the other components of the ‘Water Supply Portfolio’ including conservation measures, continued pursuit of lost water, and securing the transferred water rights for the test well.

Section 1: Introduction and Background

1.1 Authority and Purpose

Kennedy/Jenks Consultants, Inc. (Kennedy/Jenks) was retained by the City of Dundee (City) on 22 May 2012 to complete a Recycled Water Feasibility Study (Study) investigating the potential users and usage rate of Class A quality recycled water producible at the newly constructed wastewater treatment plant. With the current state of the City's water supply utility nearing capacity, this feasibility analysis will look to recycled water to meet irrigation demands as a means to reduce current and future potable water peak demands, thereby postponing the need for potable Water System improvements.

1.2 Acknowledgements

Kennedy/Jenks wishes to express our sincere gratitude to the City of Dundee, Dundee City Council, and the Oregon Water Resources Department for entrusting us with the opportunity to investigate the feasibility of expanding the recycled water system currently utilized at the wastewater treatment plant. In addition, we would like to express our appreciation for the input and support from City staff, including:

- Rob Daykin, City Administrator
- Alan Mustain, Public Works Supervisor
- Todd Miller, Wastewater Treatment Plant Operator

1.3 Background and Scope of Study

The City of Dundee is located in Yamhill County, approximately 25 miles southwest of Portland on State Highway 99W, situated in the heart of the Willamette Valley. The City offers the feel of a rural town with big city culture. A number of Oregon wineries call Dundee home and are a major tourism contributor to the City's economy. Other draws include local artesian food and dining, scenic trails along the Willamette River, reputable schools, and the proximity to larger cities.

While growth has slowed recently due to the declining national economy and burst of the housing bubble, the City is poised for additional growth, having ample buildable lands east of Highway 99W towards the Willamette River. The anticipated growth throughout these undeveloped areas is detailed in the recently accepted Riverside Master Plan. In order to accommodate this growth, the City's utilities must be able to support these additional connections, including potable water service.

Currently, the City's potable water supply is near capacity and unable to meet the demand requirements of these projected developments. Without installing significant capacity improvements, the City is faced with limited growth potential. These capacity improvements may include additional domestic wells or construction of a Willamette River raw water intake and treatment plant.

A third option considered and the basis for this Study is to explore the feasibility of the City developing and operating a Class A recycled water distribution system inside the City limits using

recycled water produced at the newly completed wastewater treatment plant (WWTP). The use of recycled water would be an incentivized alternative available to customers to individually decrease their water bill while collectively reducing the citywide potable water demand. If current and future potable water demands are sufficiently replaced by recycled water usage, potable water improvements may be delayed, or eliminated. In addition to the potential financial benefits, the implementation of a recycled water program would help alleviate pressure on groundwater sources, furthering the City's steward of the land principles.

The scope of this Study is to identify potential recycled water users, estimate recycled water demands, develop preliminary recycled water distribution alignments, estimate capital, operations and maintenance costs, determine the associated reduction of potable water demands, and compile the Study along with conclusions, recommendations and next steps into a final written report. Once complete, the final report will allow City Council to gauge the benefits of implementing a recycled water system. This will be accomplished through the following:

- Basis of Planning – Definition of the service area and basis of study, components of cost estimates, and definition of feasibility.
- Long Term Drinking Water Supply Issues – Present current water system production rates, available capacity, and future growth impacts.
- Recycled Water Supply Potential – Examining recycled water customers and demands, potential service areas, distribution system infrastructure, and service requirements.
- Feasibility Analysis – Investigating the feasibility of the proposed recycled water system.
- Recommendations related to the recycled water program, proposed phasing and alternative analysis, and the next steps the City can consider.

1.4 City of Dundee Water Supply Overview

The City's potable water supply system consists of groundwater wells, pump stations, water storage reservoirs, distribution mains, and associated water supply appurtenances including control valves, pressure reducing valves (PRVs), meters, and fire hydrants. The City operates a total of nine water production wells. Potable water is either pumped into the storage reservoirs or pumped directly into one of the four pressure zones that comprise the distribution system. Current capacity of the storage and distribution system as well as production well capabilities is detailed in Section 3 of this Study.

1.5 City of Dundee Recycled Water Supply Overview

The City owns and operates the wastewater collection system and the newly constructed WWTP that discharges treated effluent into the Willamette River at river mile (RM) 51.7. As part of the newly constructed improvements, the City is now capable of producing Class A quality recycled water. While produced water is currently only used onsite, the permitted uses of Class A recycled water allows for offsite uses, including landscape irrigation. Class A recycled water is the highest recycled water standard and is allowed the most beneficial uses; a complete list of these beneficial uses is provided in Appendix A.

The installed system, including inline ultraviolet (UV) disinfection vessels, a recycled water wet well, and installation of pumping and piping, is configured to provide high quality reuse water for onsite washdown operations. This produced water is currently used for headworks screen washings and foam suppression nozzles at the process basins, along with supply water to onsite hose bibs for general washdown purposes. While the Oregon Revised Statues (ORS) do not specifically prescribe a required dose rate necessary to produce a classification of Class A recycled water, the Oregon Department of Environmental Quality (DEQ) has mandated that a UV dosage is required to be a minimum of 80 millijoules per centimeter squared (mJ/cm2). Design capacities of the existing system are presented in Section 4.

1.6 Water Resources Department Funding

The Oregon Water Resource Department biannually funds the Water Conservation, Reuse and Storage Grant Program. This program was established by Senate Bill 1069 (2008) and is designed to fund the qualifying costs of planning studies that evaluate the feasibility of developing water conservation, reuse, or storage projects. The 2011 Legislature approved continuation of this grant program for the 2001-13 biennium through the use of Lottery-backed bonds scheduled to be issued in May 2012 and available for distribution in June 2012.

This grant program requires a dollar for dollar match by the applicant with a maximum grant award up to $500,000 for each project. The City applied for the grant in late 2011 and was awarded the requested $30,000 grant and provided with a notice to proceed. The finalized report is required to be submitted to the Water Resource Department prior to 1 June 2013.

1.7 Feasibility Study Design

The Study scope was designed to follow a series of sequential steps that would culminate in a determination of whether recycled water distribution is feasible in the City, while also providing the framework for City Council to discuss and pursue the next steps related to developing a Recycled Water Program. The sequential steps followed to complete the Study were as follows:

1. Goals and objectives of the Study were determined through discussions with both City staff and City Councilors.

2. Water demands provided by the City, including monthly meter data and daily production well flows, were used to determine current demands and estimate potential recycled water demands, followed by determination of the resulting potential service areas, distribution infrastructure, and related installation costs.

3. Distribution system requirements including pressure and flow were estimated based on the potential service areas. A preliminary distribution system was constructed and used to size distribution pumping and piping systems.

4. Capital costs related to the service areas.

5. A preliminary feasibility analysis was developed.

6. The development of conclusions, recommendations and next steps to address certain questions that were outside the scope of the Study.

Section 2: Basis of Planning

This section is provided as reference to catalog the methodologies, guidelines, and assumptions used in the development of this feasibility study. The basis of planning summarizes the following:

- Study Area Boundary (Figure 2.1)
- Customer Water Demand Estimates
- Recycled Water System Design Criteria
- Basis of Cost Estimates
- Basis for Project Feasibility Determination

2.1 Service Area

The distribution service boundary for the Dundee recycled water system was defined as the service area within the current City limits as shown on Figure 2.1. These limits define potential recycled water users and targets buildable lands east of Edwards Street commonly referred to as the Riverside Master Plan Area.

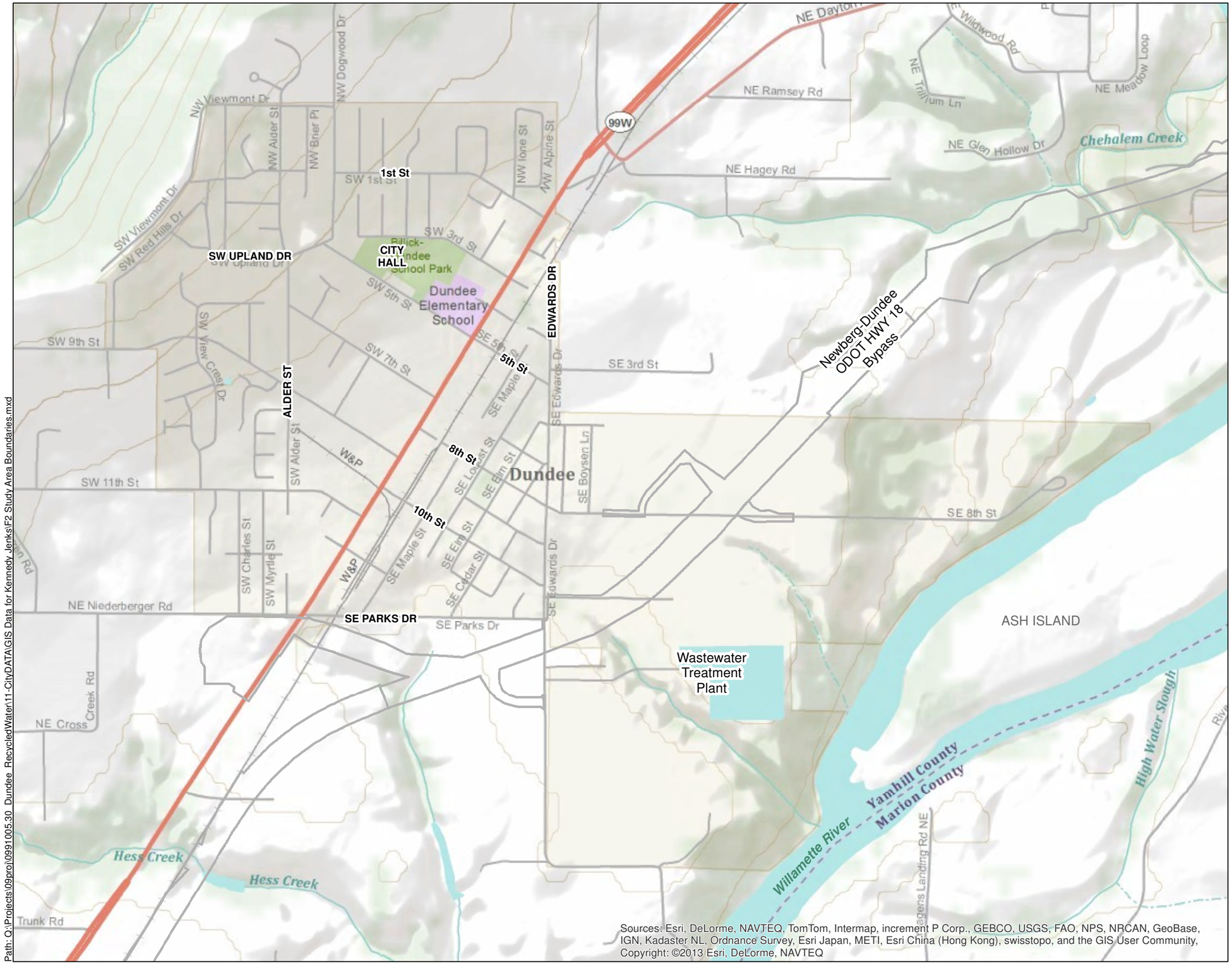
As will be discussed below, the implementation of a recycled water system will be most efficient in undeveloped areas. When developed, the distribution system can be installed easier and, therefore, less costly. While it is important and necessary to investigate potential service connections to current large demand users, installation of new individual parcel level connection throughout developed streets ladened with other existing utilities is difficult and costly.

2.2 Recycled Water System Design Criteria

The basis of design for sizing and components of the recycled water system were taken from City standards, DEQ and Oregon Health Authority (OHA) standards and generally accepted engineering principles. The design criteria are summarized below in Table 2.1.

Table 2.1: Recycled Water System Design Criteria

System Component	Design Criteria
Pipe Velocity	• Velocities were kept low to minimize head loss within the system. By keeping velocities low, there is also built in capacity for future connections and flows not currently anticipated or documented. The low velocities also allow for peaking during summer irrigation to have minimal impact on operating pressures in the system. • Maximum pipeline velocities should not exceed 8 feet per second.
System Pressures	• System pressures of approximately 50-80 psi are desirable for proper function of irrigation systems. A booster pump station will be necessary to provide system pressures equivalent to the pressures in the City's existing drinking water system to assure there are no issues with irrigation system sizing and coverage. • Looping of distribution pipes will provide greater service connection pressure and flow reliability. Of the potential areas



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community, Copyright: ©2013 Esri, DeLorme, NAVTEQ

Legend

- City Limits
- UGB
- ODOT Hwy 18 Bypass

Zoning

- Single Family Residential
- Medium Density Residential
- Community Commercial
- Central Business District
- Agriculture
- Exclusive Farm Use
- Light Industrial
- Public

N

0 1,400

Scale: Feet

1 inch = 1,400 feet

Kennedy/Jenks Consultants

City of Dundee
Dundee, OR

Recycled Water Feasibility Study
Study Area Boundaries

K/J 0991005*30
April 2013

Figure 2.1

Path: Q:\Projects\09proj\0991005.30_Dundee_RecycledWater\11-CityDATA\GIS Data for Kennedy Jenks\F2 Study Area Boundaries.mxd

System Component	Design Criteria
	served, the Recommended Plan does not currently require a looped system. However, development within the Riverside area could allow for looping. Currently, the City is intending to install a utility casing under the ODOT HWY 18 Bypass to allow future looped connection.
Pipe Type	• Distribution piping will be C900 PVC. • Pipeline will be purple to indicate recycled water
Water Quality	• Water quality within the distribution system shall meet Class A recycled water standards, defined by the City's NPDES Waste Discharge Permit, as outlined in Appendix B. • A chlorine residual of 0.5 mg/L shall be maintained throughout the distribution system.
Pipe Roughness	• Hazen-Williams Roughness Coefficient of 120 to simulate PVC pipe in service after 5 to 10 years.
Meter Sizing	• The basis for estimating meter sizes involved corresponding the potential customers' demand flows with the appropriate meter size.
Pipeline Separation	• All recycled water service lines and meters must be separated by a minimum of 5 feet horizontally and 18" vertically or 10 feet horizontally with no vertical offset, from the nearest potable water facility, including pipelines, meters, and hydrants, unless otherwise approved by DEQ and OHA. • When a recycled water main is adjacent to or crosses a sanitary sewer line, the recycled water main shall be considered a potable water main and comply with the above regulations for horizontal and vertical separation.
Other	• All recycled water valves, outlets and other appurtenances shall be designed or secured in such a manner that permits operation only by authorized personnel. • All recycled water connections must be equipped with a pressure-regulating valve and the valve must be installed in an underground box or boxes.

Abbreviations
DEQ – Department of Environmental Quality
OHA – Oregon Health Authority
mg/L – milligrams per liter
ODOT – Oregon Department of Transportation
psi - pounds per square inch
PVC - polyvinyl chloride

2.3 Basis of Cost Estimates

All cost estimates prepared as a part of this evaluation are order-of magnitude or conceptual cost estimates as defined by the American Association of Cost Engineers (AACE). An order of magnitude estimate is one that is made without detailed engineering data, and uses techniques such as cost curves and scaling factors for similar projects. The overall expected level of accuracy of the cost estimates presented is +50 percent (%) to -30%, meaning that bids can be expected to fall within a range of 50% over the estimate to 30% under the estimate for each

project. This is consistent with the guidelines established by the AACE for planning level studies.

2.3.1 Capital Costs

Capital costs are those costs associated with constructing facilities and appurtenances required for each alternative and may include pumping facilities, pipeline distribution system, metering facilities, and private side connections. No property acquisition costs have been included in estimates presented in this Study. Installation of necessary storage and pumping facilities are proposed at the City's WWTP and installation of distribution piping is proposed within existing City streets.

The cost estimates in this report are based on RS Means construction cost data for materials and prices in the Pacific Northwest area, recent local project cost estimates, and the Engineer's experience on similar projects. The estimates represent Kennedy/Jenks' professional opinion of costs on a conceptual basis and are current at Engineering News Record (ENR) of 9425.52 for Seattle, Washington in March of 2012.

Standard markups applied to conceptual construction cost estimates are summarized in Table 2.2. Cost estimates prepared for these evaluations are included in Appendix C for reference.

Table 2.2: Applied Mark-ups for Conceptual Level Cost Estimates

Item	Markup as Percent of Construction Cost
General Conditions (incl. Bonds, Mobilization)	6%
Contractor's Overhead and Profit	10%
Estimate & Construction Contingency	30%
Engineering/Legal/Administrative	30%

2.3.2 Lifecycle Costs

The overall life-cycle cost of an alternative, includes capital costs for construction of facilities, and operations and maintenance costs over a 20-year useful life.

Operations and Maintenance (O&M) costs are the estimated annual costs for City staff to operate and maintain the proposed facilities, energy costs to run proposed pumping facilities and other costs such as administrative costs that may be required. O&M Costs are based on a net present worth (NPW) of capital improvement cost and annual O&M costs. Net present worth alternative costs are based on:

- Full Time Employee (FTE) Rate: $65,000/yr
- Energy Rate Consists (PGE Schedule 85) of the following:
  - Transmission Charge $0.82/kilowatt (kW)
  - Facility Capacity Charge $2.14/kilowatt (kW)
  - Monthly Demand Charge: $1.85/kilowatt (kW)
  - Energy Use Charge: $0.06117/kilowatt-hour (kWh)
  - System Use Charge: $0.00291/kilowatt-hour (kWh)

- Discount Rate: 3%
- Evaluation Period: 20 years
- Residual Value: $0
- Annual Equipment Maintenance Sinking Fund: $5% of capital cost/year
- Annual Pipeline Maintenance Sinking Fund: $10,000/mile pipeline
- Low Interest Loan inputs:
  - Payment Term of 20 Years
  - Interest Rate of 4.0%

2.4 Methodology for Project Feasibility Determination

Feasibility is dependent upon the context and purpose in which a project is being evaluated. For this project, project feasibility was discussed with the City Council to determine that feasibility would be defined as the ability to implement a recycled water system that would offset improvements to the water supply system necessary to accommodate future growth.

Costs associated with implementing this recycled water system to the service areas defined within the Study are presented. Improvements necessary on the water supply system necessary to accommodate expected growth without implementation of this recycled water system are not included as they fall outside the scope of this Study. Improvement costs for the otherwise proposed water treatment plant were provided by City staff and based on a previously completed study.

The methodology for the feasibility determination is the following:

1. Establish current potable water usage and estimate breakdown of usage types to project future development demands.
2. Identify list of potential recycled water customers and estimate potential recycled water demands.
3. Define future development water system demands and proportion related to irrigation and other demands, such as toilet flushing, that could be served by recycled water.
4. Develop preliminary distribution system for serving potential recycled water customers.
5. Estimate the reduction in potable water demands associated with using recycled water in lieu of potable water for allowable uses.
6. Estimate capital cost estimate and annual operating cost estimate for distribution system.
7. Determine feasibility through following equations:

   Project is Feasible (Positive):
   Total Water Demand – Recycle Water Demand – Other Consumption Reductions
   < Future Potable Water Supply

   Project is not Feasible (Negative):
   Total Water Demand – Recycle Water Demand
   – Other Consumption Reductions > Future Potable Water Supply

Section 3: Long Term Drinking Water Supply Evaluation

3.1 General System Supply

The City's current potable water system relies on a system of groundwater wells, pump stations, and storage reservoirs, the interconnected distribution system, associated valves, and meters to provide portable water service to its customer base. The City's Water Management and Conservation Plan developed in November of 2012 defined the water supply system as adequate to meet the current supply demands; however, with system wide growth, the existing system will be unable to provide reliable maximum day supply service. This limits the City's ability to accept development without committing serious funds and infrastructure to the utility.

While the City does have additional groundwater and surface water rights that could provide the necessary capacity, perfecting these rights would require additional infrastructure; pumps, wells, and potential treatment facilities. However, without sufficient water to serve development, the City is faced with limited growth potential due to the inability to meet additional water demands associated with new connections.

3.2 Components of City's Water System

The City utilizes nine groundwater wells throughout the town, pumping water from the Columbia River Basalt Group Formation. The total capacity of these combined wells is approximately 0.94 million gallons per day (MGD). Additionally, the City is in the process of obtaining water rights for a test well drilled in 2005. Initial capacity evaluations estimate this test well could provide between 125 gpm to 200 gpm. A detailed breakdown of well capacity is provided below in Table 3.1.

Table 3.1: Groundwater Well Production Summary

Well Number	Well Name	Production Capacity (gpm)
3	Deep Well Site	19
5	Martsolf Well Site	110
6	Martsolf Well Site	110
1	Spring Well Site	53
2	Spring Well Site	54
7	Spring Well Site	80
8	Spring Well Site	130
9	First Street Well Site	50
10	Alder Street Well Site	50
	Total Production (gpm)	**656**
	Total Production (MGD)	**0.94**
N/A	Test Well[a] (gpm	125-200
	Projected Total (gpm)	781-856
	Projected Total (MGD)	1.12-1.23

Abbreviations / Notes:
gpm– gallons per minute
MGD – million gallons per day
a) Test well currently not in production capacity

3.3 Customer Water Demand Estimates

Water demand data used as a basis for current demand estimates and future projections consisted of monthly water meter readings for all of 2012. Additionally, daily production rates from the City's production wells were obtained for summer months, July through September, for 2011 and 2012 and used to determine maximum day demands.

3.3.1 Components of Water Demands

Municipal potable water use is generally comprised into four categories,

- Domestic: general purpose water use that encompasses water supplied to residential areas, commercial districts, institutional facilities, and recreational areas. These water services are typically metered connections with individual billing accounts.
    - Domestic water consumption includes water used by residential households used for drinking, washing, bathing, cooking, toilet flushing and yard irrigation.
    - Commercial and institutional facilities tend to vary widely by type of activity, but could include demands associated with hospitals, hotels, offices, restaurants, shopping centers and entertainment areas.
- Industrial: nondomestic water demands supplied for industries such as canneries, chemical plants or other 'high tech' industry. Within the City of Dundee, this category is mainly represented by the wineries whose water uses will be associated with production, cleaning/washdown activities, and onsite irrigation.
- Public service: Typically public service water consumption represents the smallest component of municipal water usage, but may include fire fighting, public utility water usages such as chlorinating reservoirs or new pipelines, and hydrant flushing.
- Unaccounted system losses and leakage: Every water distribution system has some component of produced water that is unaccounted for and associated with system loss or leakage. Typically, a 'sound' system will have system losses around 10% of total produced water. The City is currently actively pursuing their lost water as it falls above this standard threshold.

Each of these categorical water demands contributes to daily and seasonal flow patterns. On a daily basis, the diurnal demand characteristics are driven by daily routines, such as bathing in the morning and cooking in the evening. These daily demands are not captured on a monthly metered data set, but more evident when looking at specific reservoir flows throughout the day. On a seasonal basis, flows are driven heavily by irrigation demands. Throughout the irrigation season, typically June through October, demands, specifically peak daily demands are heavily influenced by irrigation practices. This is further accentuated by the increased domestic water consumption related to warmer weather months.

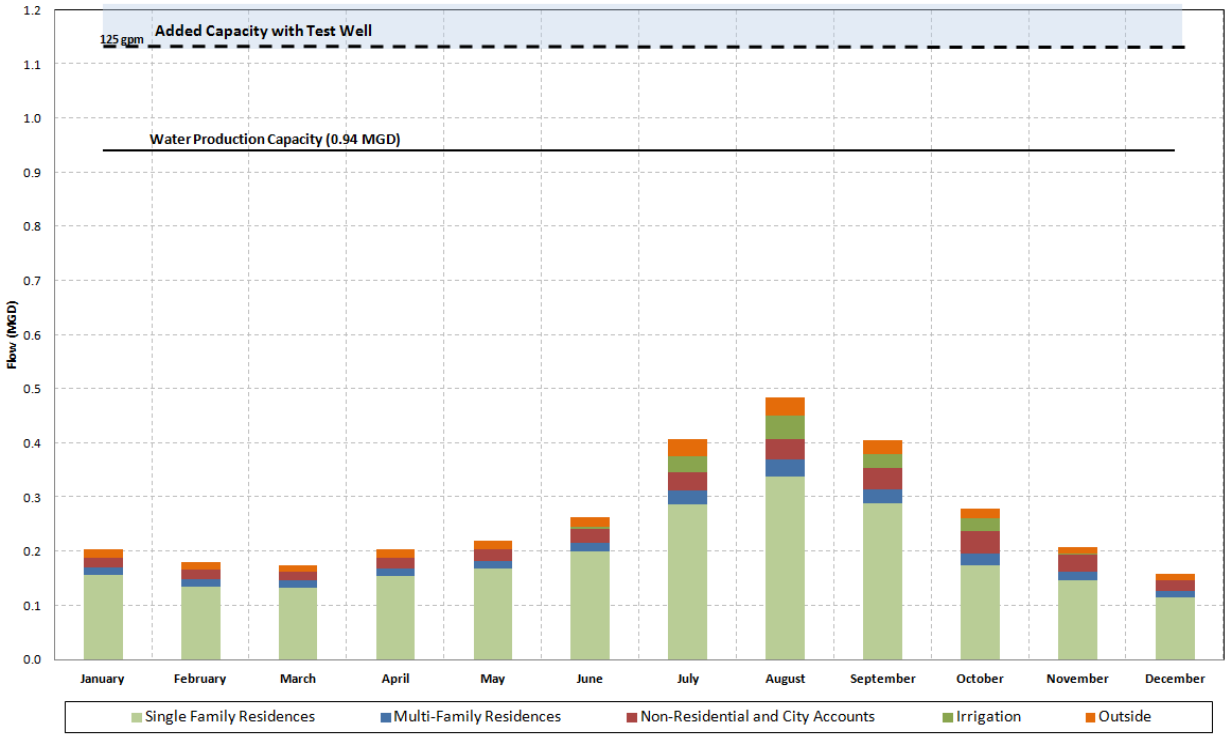


Figure 3.1: Average Monthly Water Demand by Type, 2012

Figure 3.1 is a compilation of monthly metered data collected throughout 2012 and shows that on an average monthly basis, the water system capacity of 0.94 MGD is adequate, providing a surplus of capacity for monthly average flows.

Similar to other utility system design requirements, water system capacity is needed to provide service during a peak water consumption period. Typical basis of design requirements use a Maximum Daily Demand (MDD) as the driver for sizing production, treatment, and distribution system infrastructure. In order to evaluate maximum daily demands, the City's well logs were obtained for peak flow periods throughout 2011 and 2012. Since monthly demand data indicated that July through September are peak monthly demand periods, not atypical in the Willamette Valley, daily production logs for this period were requested from the City. Figure 3.2 provides the maximum day demands found for each year, with September 2012 being found to have a maximum day demand of approximately 0.84 MGD. Also shown in Figure 3.2 are the previous six years maximum day demands. This historical data indicates that 2012 was a low demand year; therefore, demand projections carried forth in this Study present the maximum day demand of 0.90 MGD, the average of the past seven years.

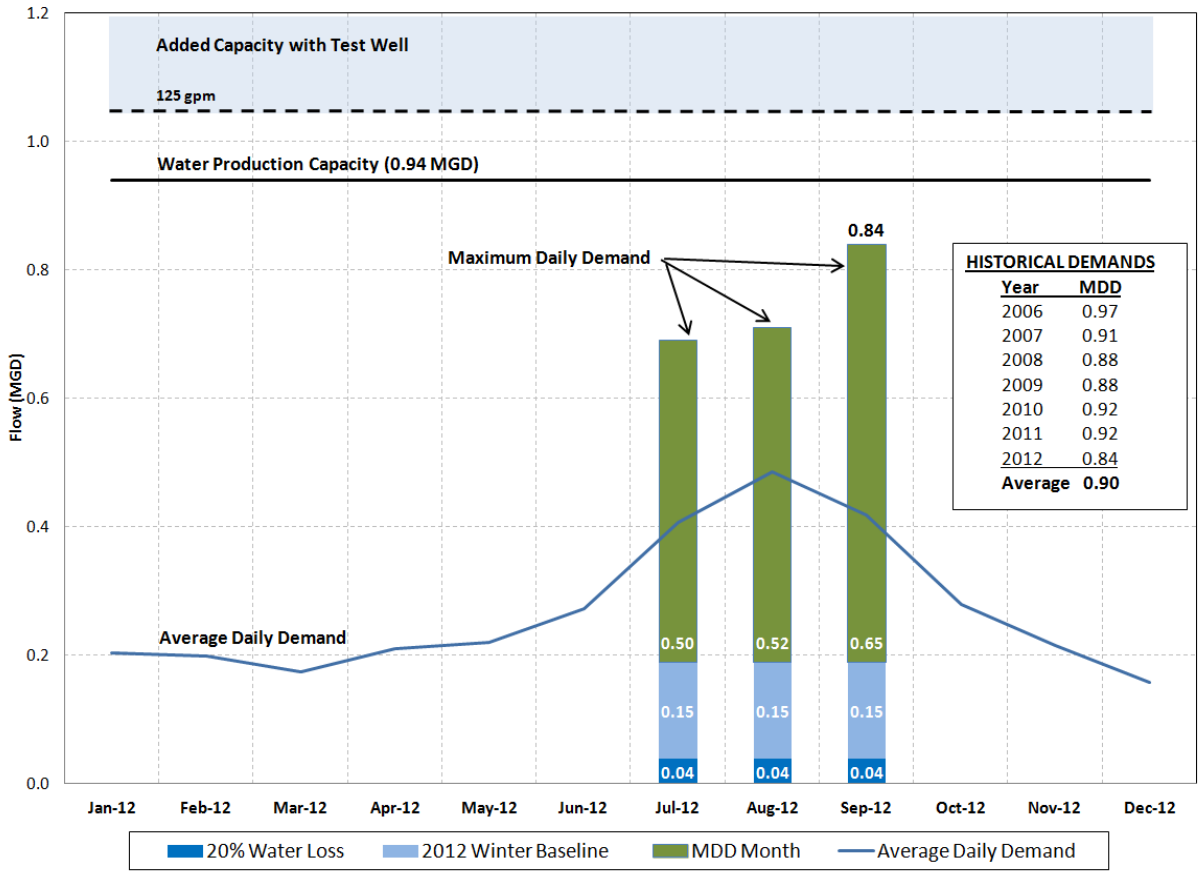


Figure 3.2: Average and Maximum Daily Demands, 2012

While average daily flows shown in Figure 3.1 are well below the water production capacity of 0.94 MGD, maximum day demands shown in Figure 3.2, and the historical maximum day demands, confirm the findings presented in the City's Water Management and Conservation Plan; the City's water supply is near capacity at peak day demands.

3.4 Water Demand Projections

The estimated maximum day demand average of the previous seven years of data of 0.90 MGD was used as a basis to project flows incurred with development throughout the service area. Since the maximum daily demand flows are an indicator of total system capacity needs, projections discussed subsequently are related specifically to the MDD flows.

Water demand projections were developed by first categorizing current water demands based on connection type and number. Winter baseline demand, summer peak demand, toilet flushing demand, and irrigation demand unit factors were developed for each of the connection types. Unit flow factors were then adjusted to reflect the lower than average demand year of 2012. These adjusted unit factors were then coupled with growth projected within the Riverside Masterplan area to project future potable water demands. Winter baseline was categorized as baseline water consumption during January through March and summer peak flows were

categorized based on the peaking factor between average monthly metered data and maximum day demands. Table 3.2 and 3.3 present unit flow factors calculated.

Table 3.2: 2012 Water Demand Summary

Flow Event	Units
2012 Annual Consumption[(a)]	13,220,125 ft3
Average Daily Demand[(b)] (ADD)	0.27 MGD
Max Daily Demand[(c)] (MDD)	0.84 MGD
MDD/ADD Ratio	3.10

Notes

a) Total 2012 City metered data
b) 2012 Annual Consumption divided by 365 days/year
c) Max Day demand found from production well daily flow logs

Table 3.3: 2012 Water Demand Unit Factors

(2012 Factors / Adjusted Factors)

Flow Factor Summary	Single Family Residence Water	Multi-Family Residence Water	Commercial/Industrial Water
Units	**1005 ERUs**	**157 Connections**	**100 Acres**
Demand (ft3)	**9,516,722**	**910,986**	**1,290,719**
ADD/ERU: (gpd/Unit)	**194 / 209**	**119 / 128**	**265 / 284**
MDD/ERU: (gpd/Unit)	**602 / 647**	**369 / 396**	**820 / 881**
ERU/Acre	N/A	**0.61**	**1.36**
Winter Baseline Demand: (gpd/Unit)	**145 / 156**	**94 / 101**	**178 / 192**
Summer Peak Demand: (gpd/Unit)	**457 / 491**	**274 / 295**	**642 / 690**
Toilet Flushing Demand: (gpd/Unit)	**39 / 42**	**25 / 27**	NA
Potable Demand: (gpd/Unit)	**106 / 114**	**69 / 74**	**178 / 192**

Abbreviations:
ADD – average day demand
ERU - equivalent residential unit
gpd – gallons per day
MDD – maximum day demand
Definitions:
Winter Baseline Demand: average daily demand January through March
Summer Peak Demand: Maximum Day Demand minus Winter Baseline

3.4.1 Irrigation Demand Estimates

The irrigation component of these projected flows was estimated by applying the agronomic irrigation rate to the expected buildout lot size. The irrigation area within these buildout lots was

then estimated based on the development types presented in the Riverside Masterplan. The estimated irrigation area coupled with the Riverside Masterplan lot densities developed the irrigation rate per equivalent residential unit (ERU). These values were then benchmarked against summer peak flow values of existing residential units, which were found to be acceptable.

The basis for irrigation rates was established using agronomic irrigation rates from the Western Regional Climate Center (WRCC) precipitation records and described by the following:

- Precipitation data was collected from the WRCC Newberg – Rex 1 Station for years 1992-2011.
- Crop evapotranspiration rates (also referred to as crop consumptive use) were obtained from Forest Grove Oregon ArigMet station for grass, 2003-2012.
- An irrigation season of May through September was used based on agronomic irrigation rates and rainfall.
- Irrigation efficiency of 75% taken from Handline Sprinklers from the Washington Water Resources Program Guidance Determining Irrigation Efficiency and Consumptive Use.
- Evaporation data from WRCC N Willamette EXP Station, 1963-2005.
- Evaporation efficiency of 70% used to adjust pan evaporation data to naturally existing lake surfaces.

Table 3.4 presents the monthly water balance that was used for the agronomic irrigation rates described above and used throughout this Study.

Table 3.4: Pasture and Turf Agronomic Irrigation Rates

Month	Ave Precipitation (in)[(a)]	Et crop (in)[(b)]	Pan Evaporation (in)	Net Irrigation (in)[(c)]	Net Evaporation (in)
Jan	6.97	0.51	0.4	0.0	0.0
Feb	4.52	0.95	0.8	0.0	0.0
Mar	4.52	1.71	1.6	0.0	0.0
Apr	3.50	2.73	2.3	0.0	0.0
May	2.67	4.06	3.6	1.4	0.9
Jun	1.58	4.66	4.2	3.1	2.6
Jul	0.44	6.23	5.2	5.8	4.7
Aug	0.60	5.26	4.7	4.7	4.1
Sep	1.42	3.44	3.3	2.0	1.9
Oct	3.72	1.52	1.7	0.0	0.0
Nov	7.03	0.60	0.7	0.0	0.0
Dec	7.53	0.41	0.4	0.00	0.0
TOTAL	**44.48**	**32.08**	**29.0**	**16.9**	**14.3**

Comparing summer peak flows to irrigation flows estimated, it is evident that summer peak flows consist of other contributions besides just irrigation. By assuming recycled water will only be used for irrigation purposes, the estimated recycled water consumption is conservative. There may be additional flow demands that can be satisfied via recycled water once a program is in place. Calculations associated with these irrigation demand estimates are presented below in Table 3.5

Table 3.5: 2012 Maximum Day Irrigation Demand Unit Factors

Flow Factor Summary	Single Family Residence Water	Multi-Family Residence Water	Commercial/Industrial Water
Average Lot Size: (acres)	**0.10**	**0.06**	**N/A**
Irrigation Area (%)	**30%**	**25%**	**10%**
Irrigation Demand: (gpd/Unit)[(a)]	**203**	**105**	**676 (gpd/Acre)**

Notes:

a) Irrigation demand based maximum day agronomic rates presented in Table 3.5

3.4.2 Other Potential Demand Estimates: Toilet Flushing

For the purposes of estimating the component of water consumption dedicated to toilet flushing, a standard metric was used for residential connections. Commercial connections are typically more difficult to estimate due to varying levels of service commercial properties may provide. For example, in order to determine flushing demands at a specific restaurant or service store, actual tallies of customers served would be necessary, data which is difficult to obtain. For this reason, commercial toilet flushing has not been included in the evaluations.

- Toilet flushing was assumed to use 27% of residential interior water use as taken from Metcalf and Eddy, Fourth Edition.

3.4.3 Expected Development

Unit factors presented in Table 3.3 coupled with developed units published in the Riverfront Masterplan were used to develop and project development flow demands.

Since development timing is difficult to predict, the growth projections presented below are tied to equivalent residential units (ERUs). By projecting development related to ERUs, the City will have a trackable metric (building permits) that can be used to tie growth to expected demands.

Table 3.6: Riverside Masterplan Summary of Growth Type

	Single Family Residential (Units)	Multifamily Residential (Units)	Commercial (Acres)	Light Industrial (Acres)	Agricultural/ Recreational (Acres)
Subarea A	96	14	14		4
Subarea B	0	0	0	13	0

	Single Family Residential (Units)	Multifamily Residential (Units)	Commercial (Acres)	Light Industrial (Acres)	Agricultural/ Recreational (Acres)
Subarea C	24	40	0	0	0
Subarea D	222	55	8	0	2
Subarea F	415	104	0	0	2
Subarea G	0	0	0	0	30
Total Units	**757**	**213**	**22**	**13**	**38**
ERU/Unit	1	0.61	1.36	1.36	8.42
ERUs:	**757**	**131**	**30**	**18**	**320**
				Total ERUs	**1,255**

Notes:
Subareas as defined in the Riverside Masterplan.

3.4.4 Projected Demands

Table 3.6 development ERUs coupled with Table 3.3 unit flow factors were used to project water demands associated with expected growth. Since the maximum daily flow will be used as the driver for necessary water system improvements, Figure 3.3 presents maximum daily projected flowrates as ERUs are added.

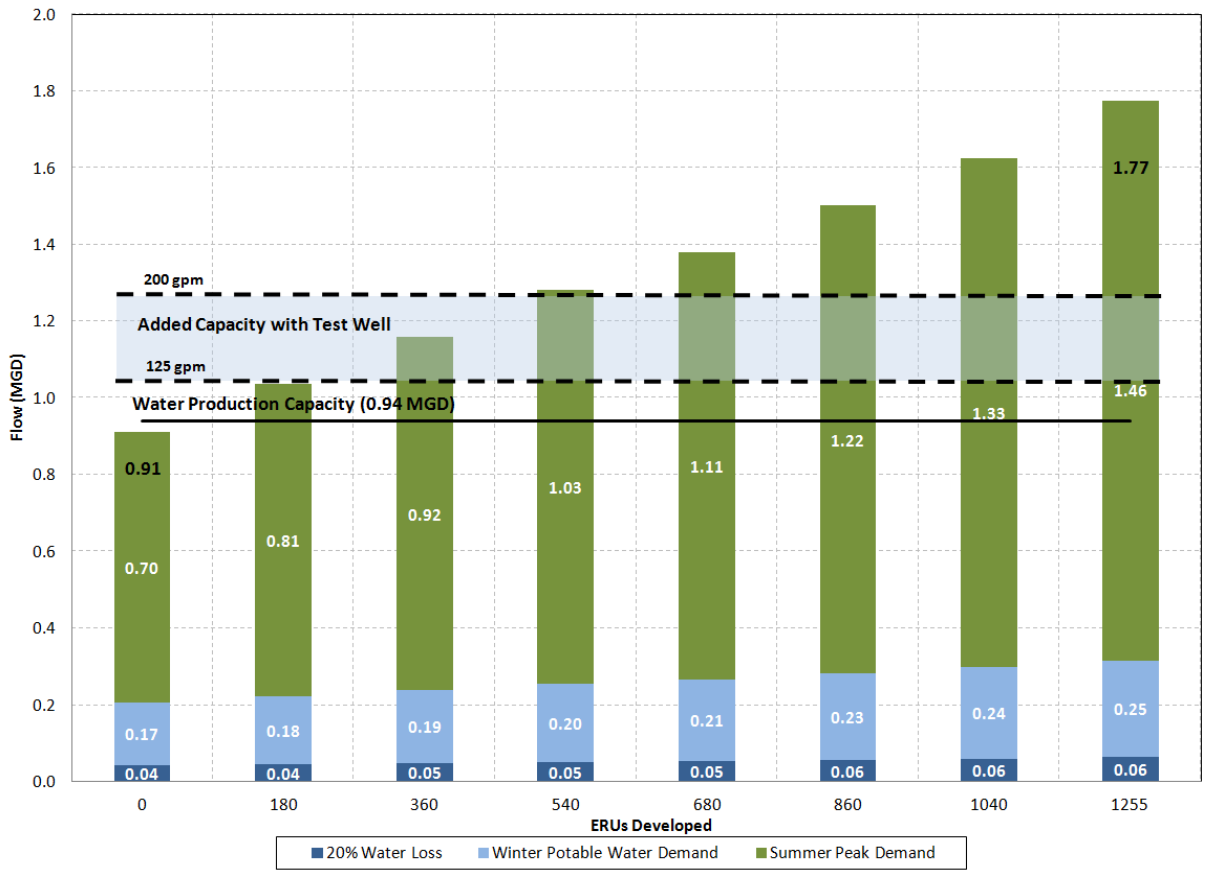


Figure 3.3: Projected Water Demands

As shown, the water demand projections indicate very little additional growth can be supported under the current supply, estimated at approximately 45 additional ERUs. With the ERUs presented in the Riverside Masterplan, the total peak day water demand is anticipated to be approximately 1.77 MGD.

Section 4: Potential Recycled Water Customers and Estimated Demands

The development of the recycled water system will include a phased installation approach, with initial phases targeting high water consumption sources. Servicing these sites is a two-fold approach; decreasing current potable water peak day consumption, while developing the City's recycled water infrastructure in preparation for the next development wave.

4.1 Existing Recycled Water Production Capacity and Quality

The onsite recycled water system installed during the WWTP upgrades, eliminates the need for potable city water for non-potable water needs such as equipment cleaning, facility washdown, and irrigation. A summary of this installed equipment and current capacities are presented below in Table 4.1

Table 4.1: Installed Recycled Water System Capacity

Ultraviolet Disinfection System	
Number of Class A RW Units	1
Type	High Intensity, Medium Pressure
Design Dosage	80 mJ/cm2
Class A Capacity	0.85 MGD
Utility Water Pump System	
Number of Pumps	2
Pump Design Capacity	110 gpm at 230' TDH
Pump Range	50-110 gpm
Horsepower (each)	15 HP
System Pressure	90 psi
Utility Water Wet Well System	
Wet Well Storage Volume	6,700 gallons
Well Chlorination System	Tablet Feeder
Chlorine Residual	3 mg/L
Dry Chemical Capacity	62 Lbs

As shown in Table 4.1, the current installed capacity of the pumping system is 220 gallons per minute (gpm) (0.32 MGD) and the UV disinfection capacity is 0.85 MGD.

4.2 Potential Recycled Water Customers

Two primary customer bases were defined for recycled water:

- Current potential customers: Existing connections with high water consumption. Targeting current customers would help reduce the current peak potable water demands.

- Future potential customers: Future developments which would include recycled water service connections at an individual taxlot scale. This also includes commercial, industrial, parks, and other development types planned for the Riverside Masterplan area.

Potential recycled water demands across both customer bases is largely comprised of irrigation demands. Other non-irrigation demands serviceable with recycled water consist of year-round demands that are observed consistently throughout the year, regardless of season or precipitation, typically including toilet flushing, cooling tower usages, or other process specific usage.

Generally speaking, these non-irrigation demands either do not exist, or are minimal demands within the City of Dundee. For example, the City is home to many wineries that could support non-seasonal recycled water flows; however, past discussions with these facilities found minimal interest in recycled water. Therefore, the predominant serviceable demand is irrigation. Additionally, servicing existing homes with new recycled water connections (distribution piping, meters, etc.) is not cost effective and has been excluded in existing development flow demand projections. However, toilet flushing in new developments was tabulated and is presented as a possible recycled water demand.

Four areas were found to be high value targets based on water consumption, locations, and potential future connection drivers. These areas include the following:

- **Area 1:** Wastewater Treatment Plant (WWTP)
- **Area 2:** Dundee Billick School and Park
- **Area 3:** Other In-City properties
- **Area 4:** Riverside

4.2.1 Area 1: Wastewater Treatment Plant

The City owned property at the wastewater treatment plant grounds will continue to be served with recycled water. In addition to the wastewater treatment plant demands, the land recovered through the decommissioning of the lagoons is anticipated to be developed into a new natural park and trail system. Water demands developed by this park are expected to include landscaping irrigation and evaporation demands across the surface of the proposed ponds and streams. A summary of the estimated recycled water demand calculations is presented below in Table 4.2.

Table 4.2: WWTP and Nature Park Irrigation and Evaporation Demands

Month	Irrigation (gpd)		Evaporation (gpd)
	ADD	MDD	ADD
May	28,100	56,400	4,100
June	62,500	125,400	11,900
July	117,100	234,900	20,800
August	94,300	189,200	18,200
September	40,900	82,100	8,400
Total (gpd)	**342,900**	**688,000**	**63,300**

Both of these demands at the WWTP will be served by the recycled water system; however, because neither is currently served by the potable water system, recycled water consumption at the WWTP and nature park will not decrease current potable water demands. In other words, providing recycled water in Area 1 does not impact the current potable water supply issues simple because recycled water is already used at this location. However, the relatively large and consistent demands for both the plant and nature park are recommended to be served exclusively with recycled water because it is simply not sensible to serve the plant or nature park with potable water give the current capacity concerns and the minor cost impacts to serve these demands from the existing recycled water system.

4.2.2 Area 2: Dundee/Billick School and Park

One of the largest in-town water consumers is the Dundee/Billick School and Park. The large fields surrounding the school require significant irrigation during summer months. In addition to providing a great opportunity to trim current peak flow demands, the development of this location creates a distribution 'backbone' along Edwards Street and west along 5th Street, an alignment that would provide tie-in locations to serve future development.

Additionally, should the adjacent orchard located on the south side of 5th Street be developed, the installed pipeline serving Dundee/Billick School and Park could be used to also provide service to this parcel.

Lastly, servicing the Dundee/Billick school provides the City and City Council with a tangible cornerstone project showcasing the City's support and belief in the recycled water program. The educational setting could also provide the conduit to educate and inform citizens of the City's water cycle, the role of recycled water, and its benefits and the perceived risks.

A summary of the irrigation demands estimated based on the agronomic irrigation rates and 2012 usage is presented in Table 4.3 for the Dundee/Billick school.

Table 4.3: Dundee/Billick School and Park Irrigation Demands

	2012 Metered Water	Agronomic Rate Based (gpd)	
Month	**ADD**	**ADD**	**MDD**
May		17,200	34,500
June		39,500	79,200
July	17,167	71,600	143,700
August	27,295	57,700	115,700
September	17,728	25,900	51,900
Total (gpd)	**62,189**	**211,900**	**425,000**

Compared to the estimated agronomic application rates, it appears Chehalem Parks and Recreation did not irrigate the school and park in 2012 as much as agronomic rates allow, potentially a water conservation and savings measure. While 2012 metered data as a whole

was found to be lower than the average, the more conservative 2012 application rates will be carried forward.

4.2.3 Area 3: Other In-City Users

Other in-city existing high volume water consumption users were tabulated to determine the extent of current irrigation demands that could be targeted for recycled water service. These high volume end users included:

Area 3A: Fortune Park

Area 3B: In-City private properties; Argyle and Ponzi Winery's tasting rooms (exterior irrigation demands)

Area 3C: Falcon Crest Park

Each of these locations was found to have higher than average peak water usage, indicating onsite seasonal irrigation. A summary of the irrigation demands estimated based on the agronomic irrigation rates presented in Table 3.4 for each of these areas is provided below in Table 4.4. As shown, the application rates at these locations are in line with the agronomic rates estimated. For the purposes of consistency, the Dundee/Billick School and Park, the applied 2012 rates will be carried forward.

Table 4.4: In-City Irrigation Demands

Month	3A: Fortune Park			3B: Argyle/Ponzi			3C: Falcon Crest		
	2012 ADD(1)	ADD(2)	MDD	2012 ADD(1)	ADD(2)	MDD	2012 ADD(1)	ADD(2)	MDD
May	149	1,000	2,000	607	500	1,000	0	2,600	5,200
June	3,92	2,200	4,500	3,478	1,100	2,200	50	6,000	12,000
July	4,064	4,100	8,100	5,271	2,000	4,100	4,139	10,800	21,700
August	3,717	3,300	6,600	3,279	1,600	3,300	10,347	8,700	17,500
September	2,513	1,500	2,900	3,452	700	1,500	2,593	3,900	7,800
Total (gpd)	**10,835**	**12,100**	**24,100**	**16,087**	**5,900**	**12,100**	**17,129**	**32,000**	**64,200**

Notes:

(1) 2012 ADD based on 2012 metered data
(2) ADD based on agronomic irrigation rates
Flows presented are in Gallons per Day (GPD)

Compared to flow demands determined at the WWTP and Dundee/Billick Park, the recycled flows associated with these in-city locations are relatively small. Any significant piping alignments needed to serve these locations is likely going to be cost ineffective. Fortune Park and potentially private properties in close proximity to the backbone alignment serving Dundee/Billick Park may be locations where irrigating these types of single point lots makes sense; however, specific dollars per gallon ($/gallon) service costs are going to be quite high.

4.2.4 Summary of Potential RW Current Customers

Maximum day demands presented above and their impacts to potable water flows are presented in Figure 4.1. The baseline condition, the existing potable water maximum day demand is provided for reference. This is the same baseline presented above in Figure 3.2 and shows current maximum day demand of 0.90 MGD. Since potable water maximum day demands occur in September, the basis for the recycled water demands presented is also associated with September. The subsequent bars indicate the impacts on existing potable water demands. Note that since the current recycled water demands at the WWTP are not met with potable water, there is no reduction in current potable water demand.

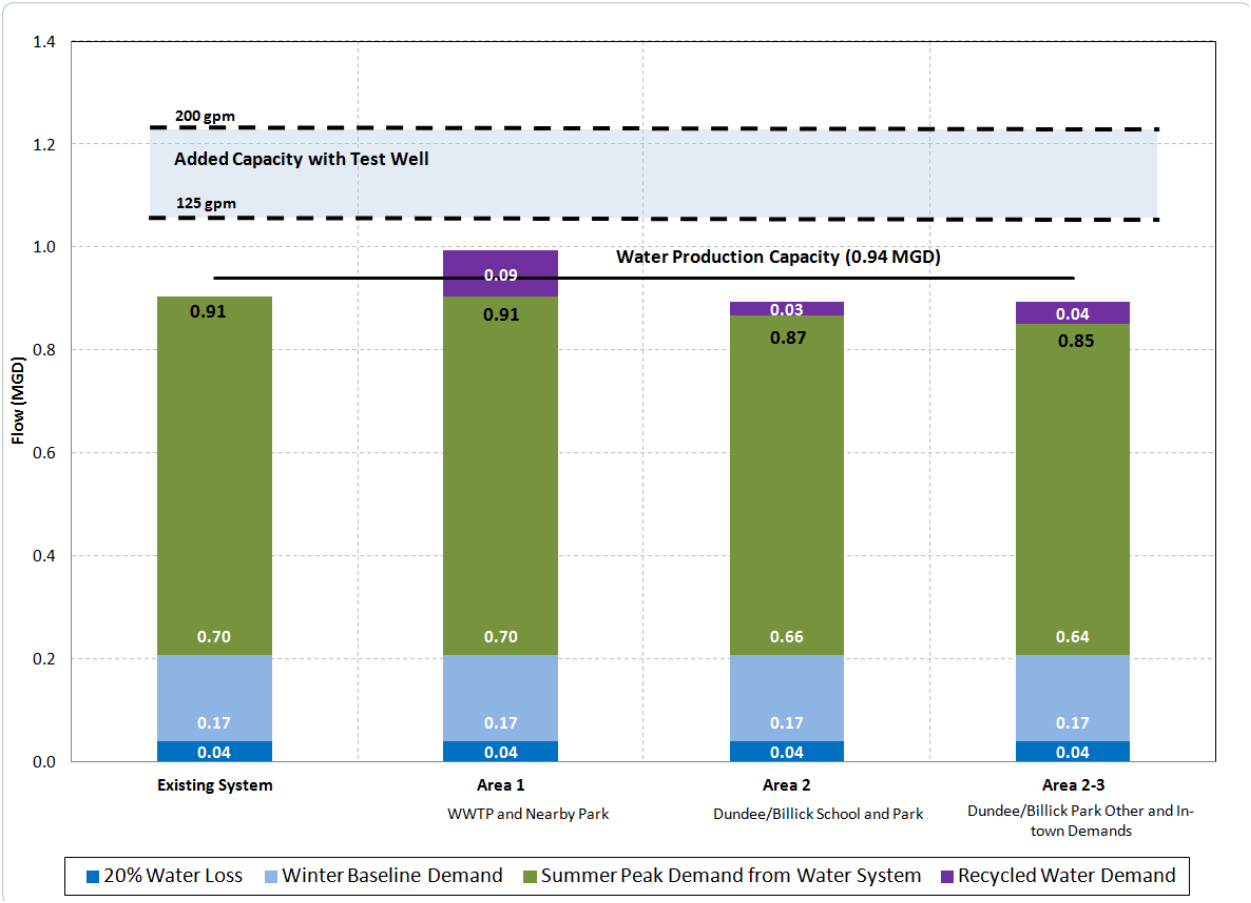


Figure 4.1: Recycled Water Service Area Demand Summary

The irrigation demand tables presented above indicate the greatest current water demands are in Areas 1 and 2, the WWTP and Dundee Billick School and Park. Smaller parks and individual metered lots currently consuming elevated irrigation rates, Area 3, are relatively low impact services.

Section 5: Alternative Cost Evaluations

Capital construction costs have been developed for the major system improvements related to each of the service areas presented in Section 4. These costs include main transmission line installation, booster pump stations, valves, fittings, general waterline appurtenances, and paving repair. No property acquisition cost is included as all areas considered is either City owned or within existing City streets.

Installation of the recycled water distribution system serving future development is not included in cost estimates as these are expected to be the responsibility of the developer. This includes any individual recycled water meter and vault installation and connection to transmission main.

Annual operations and maintenance costs provided below were developed based on the following cost factors:

Table 5.1: Operations and Maintenance Cost Components

O&M Component	Assumptions
Pump Station Maintenance	Assumed to be 5% of the pump station capital cost.
Pipeline Maintenance	Assumed to be $5,000 per mile of pipeline.
Power Cost	Portland General Electric rates: Transmission Charge $0.82/kW Facility Charge $2.14/kW Monthly Charge $1.85/kW Energy Use Charge $0.06117/kWh System Use Charge $0.00291/kWh

5.1 Preliminary Recycled Water Distribution System

Hydraulic system performance necessary to provide flows and operating pressures of 70 pounds per square inch (psi) were used to determine pump selection and system sizing. Pipeline sizing, design velocity and pressures were developed through system headloss calculations using peak design flowrates. Through adjusting distribution pipe sizes to minimize headloss and calculate pressure of water delivered to the potential customers, the preliminary distribution system was developed.

5.2 Preliminary Recycled Water System Alignment

For each of the potential connection areas, pipe routing options were evaluated. These proposed distribution system layouts were used for the development of the hydraulic system needs. These alignments were developed based on Geographic Information System (GIS) data provided from the City. The alignments proposed were based on maintaining 3-feet minimum cover, 5-feet horizontal and 18-inch vertical separation from existing potable water pipelines, and abiding by ORS requirements at all crossing locations.

These alignments include:

- **Area 1** – Onsite WWTP piping and distribution. This network is mainly in place, improvements at the plant installed much of the necessary onsite utility water piping. Additional piping needs will be related to final layout of the nature park and irrigation landscaped areas. Onsite WWTP recycled water service is proposed to utilize the existing utility water (UW) pumps currently onsite. Depending on flows, this could require installation of the third UW pump within the blank spot on the skid.
- **Area 2** – Dundee Billick School and Park – Alignment north on Edwards and west on 5th street. This alignment includes existing water, sewer, and stormwater piping. The proposed alignment is included in Figure 5.1.
- **Area 3 –** Area 3 is comprised of existing in City connections with elevated demands. Each of these subareas was investigated individually, looking at cost impacts to install distribution system piping compared to potential demands available for recycled water. Each location is also shown on Figure 5.1.
- **Area 3A: Fortune Park** – Existing City park located southwest of the 5th Street backbone. Service to this location would require installation of 6-inch piping along Maple Street.
- **Area 3B: Highway 99 Properties** – Ponzi Tasting room and Argyle wineries were found to have elevated seasonal demand, likely a result of the onsite landscaping. Service to these properties would entail installation of 6-inch piping from the 5th Street backbone parallel to Highway 99. The cost to install this alignment considers the difficult construction associated with installation within the highway corridor.
- **Area 3C: Falcon Crest Park** – While a more remote location, irrigation demands at the park were great enough to be considered for this Study. Distribution system piping would consist of piping from Edwards Street along Park, across Highway 99, down Alder and west to the park.
- **Area 4: Future Development** – Distribution system connected to all potential future development customers within the Riverside Masterplan area. Distribution system alignment will be defined by City approved development layouts, but may consist of a trunkline along 8th Street and or service south from the WWTP.

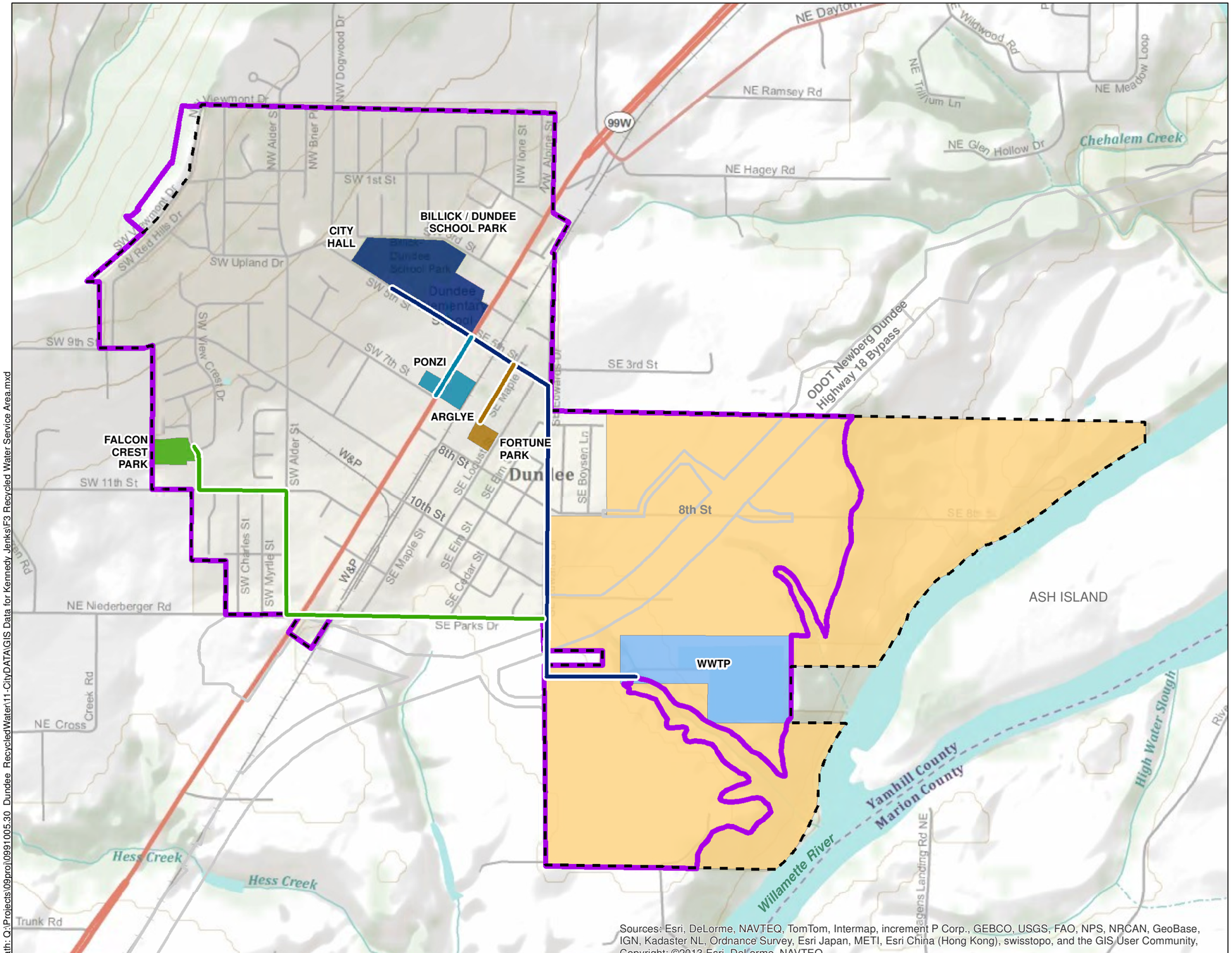
Figure 5.1 presents the preliminary alignment of the distribution systems and the locations of the proposed service areas.

Velocities within the proposed system range from 0.1 to 2.3 feet per second (fps). Most velocities were below 1 fps with larger velocities observed in larger transmission pipes closer to the WWTP connection. Velocities during peak flows remained considerably under the limit of 8 fps.

5.2.1 Area 1: Wastewater Treatment Plant

5.2.1.1 System Infrastructure Required

Onsite demands at the WWTP will continue to be served via existing equipment. Expected current and future demands are well within current supply capacities; therefore, no additional equipment costs would be necessary for buildout of the pond system.



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community, Copyright: ©2013 Esri, DeLorme, NAVTEQ

Legend

Proposed Pipelines Alignments

- Area 2: Pipeline
- Area 3A: Pipeline
- Area 3B: Pipeline
- Area 3C: Pipeline
- City Limits
- UGB
- ODOT Hwy 18 Bypass

Recycled Water Service Areas

- Area 1: WWTP
- Area 2: Billick / Dundee School & Park
- Area 3A: Fortune Park
- Area 3B: Ponzi Tasting Room & Argyle Winery
- Area 3C: Falcon Crest Park
- Area 4: Riverside District Development

N

0 1,400

Scale: Feet

1 inch = 1,400 feet

Kennedy/Jenks Consultants

City of Dundee
Dundee, OR

Recycled Water Feasibility Study
Recycled Water Service Area
Piping Alignments

K/J 0991005*30
April 2013

Figure 5.1

Path: Q:\Projects\09proj\0991005.30_Dundee_RecycledWater\11-CityDATA\GIS Data for Kennedy Jenks\F3 Recycled Water Service Area.mxd

Source:

Additional onsite piping needs will include extension of the utility water distribution system to the headwaters of the nature ponds as well as piping from the pond tailwaters back into Lagoon 4. As more definitive plans are developed for the nature park, these piping alignments can be refined; however, the approximate alignment and size are shown on Figure 5.2 and consist of approximately 350 feet of 6-inch pipeline. Costs included in Table 5.3 include estimated costs for the Nature Park; however, since this project is anticipated to be funded by a grant or from another City utility, the construction cost is not included in the 20-year cost evaluations. The Nature Park estimated costs are provided for total system costs discussed in this section.

5.2.1.2 Estimated Installation Cost

Construction costs associated with the ponds, trails, plantings, etc., along with the new pipeline to connect the downstream nature park pond to Lagoon 4 are summarized below in Table 5.2.

While the existing equipment will provide sufficient capacity for these onsite uses, once recycled water service is needed offsite, both recycled water pumping and storage systems will be necessary. These distribution system pumps will be better sized to provide the flow and system pressures necessary and onsite storage will provide flow buffering, preventing the WWTP from peak production spikes across diurnal irrigation flows. Typical sizing criteria for onsite storage capacity is one to two times a maximum daily flow, a volume that optimizes water turnover rates while providing sufficient volume to address peaking demands. A reservoir volume of approximately 500,000 will result in approximately 1.5 turnovers per day at future maximum day demands. In addition to providing flow storage, the reservoir could also be used to store fire flow volumes onsite to supplement fire suppression systems currently being proposed at the Public Works building. Proposed design criteria for onsite pumping and storage is provided in Table 5.2.

Table 5.2: Onsite Pumping and Storage Design Criteria

Pumping Design Criteria		Storage Design Criteria	
Pump Number	2	Reservoir Size (Gallons)	500,000
Size (HP)	50	Turnover/day[(1)]	1.5
Design Flow (gpm)	300		
Design Head (feet)	290		

Abbreviations:

HP – horsepower
1: Turnover at maximum day demand

5.2.1.2.1 Storage Evaluations

Onsite options for storage of recycled water include open pond storage or an enclosed reservoir.

Open Pond Storage

An open storage pond would consist of a high-density polyethylene (HDPE) lined pond located onsite at the WWTP grounds. Storage volumes proposed in Table 5.2 result in an approximate footprint of 100-feet by 80-feet and 8 feet deep. In order to maintain water quality, chlorine residual would be necessary to prevent biological growth (algae). The chlorine residual would help minimize the water quality effects of aquatic life, but be challenging to maintain.

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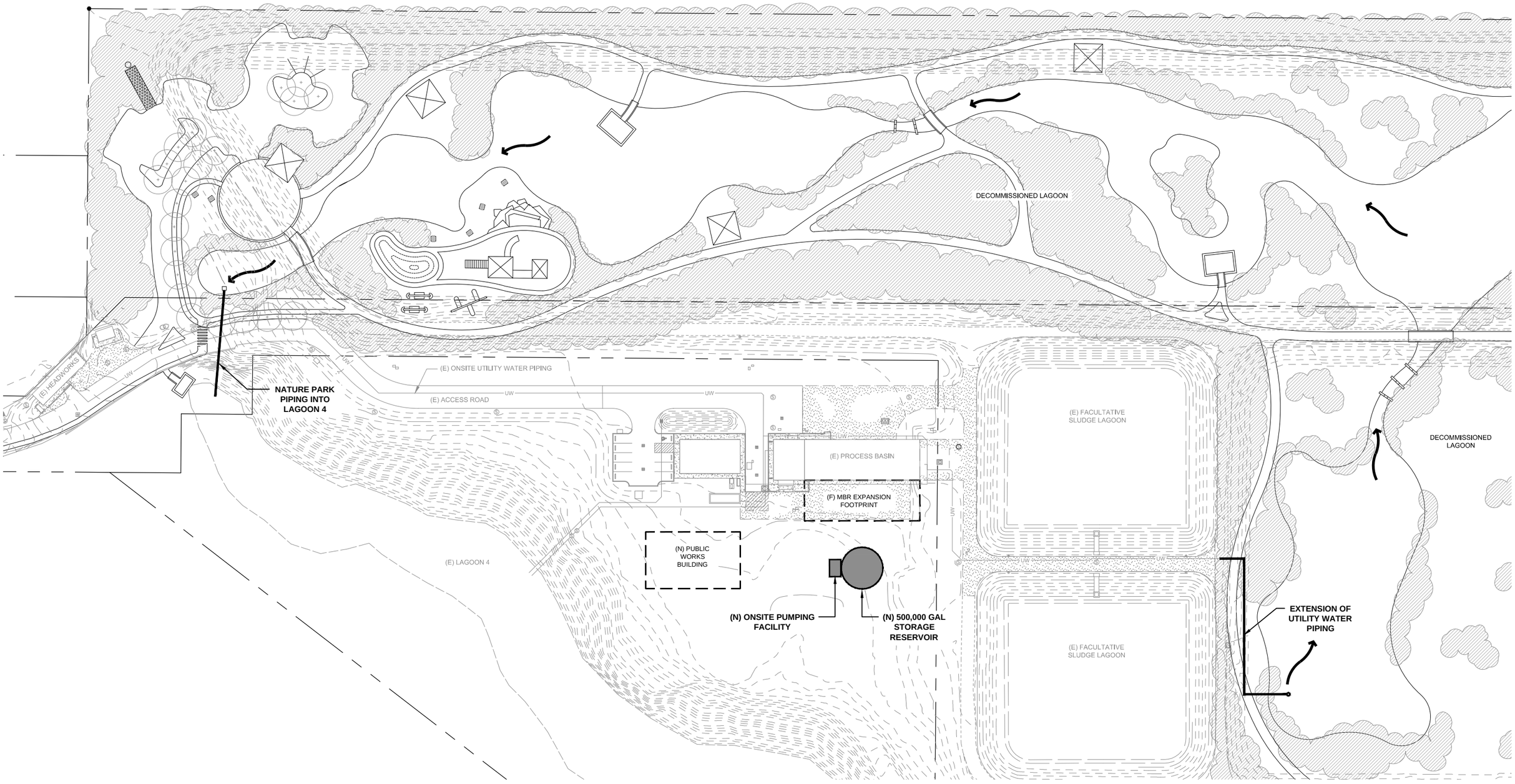

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Kennedy/Jenks Consultants

CITY OF DUNDEE
RECYCLED WATER
FEASIBILITY STUDY

AREA 1 - WWTP AND NATURE PARKS SITE LAYOUT

K/J 0991005.30
MAY 2013

FIGURE 5.2

While the open storage reservoir dimensions are deeper than the ponds proposed for the nature park, the footprint of the proposed storage pond is similarly sized to the first of the proposed nature ponds. If this pond were to be deepened, it could provide the volume capacity necessary for offsite demands. One drawback to this configuration would be the need to maintain the chlorine residual required for offsite applications, a dosage that would likely prohibit support of aquatic life anticipated throughout the nature park; however, the cost effectiveness of an open pond reservoir, especially if it can utilize one of the proposed nature ponds, is positive.

Reservoir

Many material options exist for reservoirs including plastic, fiberglass, concrete, and steel. Tank sizes being proposed for onsite storage at the WWTP are outside the normal capacity range of plastic and fiberglass. Therefore, concrete and steel are more appropriate options. Concrete reservoirs will have a higher initial capital cost, while steel tanks may have a greater long term maintenance cost. However, both tank types can provide long service lives, generally on the order of 50+ years and each will have similar footprint and construction dimensions.

One of the considerations of onsite reservoir storage at the WWTP is the foundation design. Onsite soils at the WWTP are known to be subject to liquefaction settlement during an earthquake event. Mitigation of this settlement will require an engineered foundation design, increasing cost to install.

Similar to the open pond reservoir, an enclosed reservoir will require chlorination; however, the chlorine dosage is expected to be less than an open reservoir.

Both tank designs should be brought forward for future design evaluation. For the purposes of this Study, the footprint and proposed location is presented in Figure 5.2.

Table 5.3: WWTP and Nature Park Cost Summary

Parameter	Capital Cost	Yearly Cost
Nature Park and Ponds	$1,202,000	$6,500
Onsite Piping Improvements	$48,000	$700
Onsite Storage and Pumping[(a)]	$2,060,000	$1,600

Note:
a) Bolted steel reservoir used for basis of storage cost estimate

5.2.1 Area 2: Dundee/Billick School and Park

5.2.1.1 System Infrastructure Required

The proposed piping alignment from the WWTP to Dundee/Billick school and park is shown on Figure 5.1 and consists of approximately 7,000 feet of 8-inch C900 PVC.

5.2.1.2 Estimated Installation Cost

Construction costs associated with the alignment to the school and park are summarized below in Table 5.4 and are estimated at approximately $710,000.

Table 5.4: Dundee/Billick School and Park Pipeline Costs

Parameter	Capital Cost	Yearly Cost
Installation Cost	$710,000	$6,600

5.2.2 Area 3: Other In-City Users

5.2.2.1 System Infrastructure Required

Piping alignments servicing each of these areas is presented in Figure 5.1. These connections and alignments have been used to develop the basis of cost for each location and assume that the 'backbone' system is installed.

Providing service to these locations requires piping installation within existing roadways, many of which are burdened with other existing utilities. The piping alignments are further complicated by the offset distances between recycled water and potable water pipelines.

In order to estimate costs associated with these alignment, a per unit foot cost of pipe was developed. Feasibility level alignments were developed, considering proximity requirements between proposed recycled water and potable water pipelines.

5.2.2.2 Estimated Installation Cost

Construction costs associated with each of these are summarized below in Table 5.5.

Table 5.5: In-City Connection Cost Summary

Parameter	Capital Cost	Yearly Cost
Fortune Park	$80,000	$900
Highway 99 Properties	$130,000	$700
Falcon Crest	$510,000	$5,000

5.3 Summary of Service Area Costs

A summary of the capital construction costs for the service areas defined above are shown in Table 5.6. These costs include markups for contractor general conditions, overhead and profit, contingency and engineering legal and administrative costs as detailed in the Basis of Cost Estimates in Table 2.2. Detailed breakdowns of the cost estimates are included in Appendix C.

Table 5.6: Estimated Capital Construction Costs for Recommended Plan

Location	Estimated Capital Cost	$/Gallon[b]	Estimated Annual O&M
WWTP Onsite Piping	$ 48,000	$ 0.55	$ 700
Onsite Storage and Pumping[a]	$ 2,060,000		$ 1,600
Dundee Billick School and Park	$ 710,000	$ 19.94	$ 6,600
Fortune Park	$ 80,000	$ 15.84	$ 900
Highway 99 Properties	$ 130,000	$ 18.74	$ 700
Falcon Crest Park	$ 510,000	$ 97.89	$ 5,000
Totals used in Program NPW Evaluation	**$ 3,538,000**		**$ 15,500**

Notes:
a) Located at the WWTP
b) $/Gallon based on Capital Cost divided by Maximum Day Recycled Water Demand

Costs associated with developer connections and installations/services to future developments is expected to be the responsibility of the developer and are not included as City costs.

Section 6: Impacts to Long Term Water Demands

6.1 Recycled Water Demand Spectrum

Many factors will contribute to the actual flows and demands offset by the recycled water program. These factors may include political decision making at a City Council level, effectiveness of outreach and educational programs, and overall buy-in from citizens. Because of these difficult to quantify factors, a range of recycled water demands is presented below in Figures 6.3-6.5. Each of the three graphs provide overall water supply capacity projections based on a low, medium, and high recycled water usage across the presented Service Areas.

Recycled water demands are represented by purple segments and include serving the WWTP, Dundee Billick School and Park, Area 3, and future development irrigation, and toilet flushing. The high end of these segments represents an aggressively pursued program, likely requiring ordinance level policy making necessary to ensure 100% of serviceable demands are satisfied by recycled water. The lower ends represent a more conservative serviceability, for example, only assumes 10% of serviceable demands are met with recycled water, while the medium consumption assumes a 65% service rate.

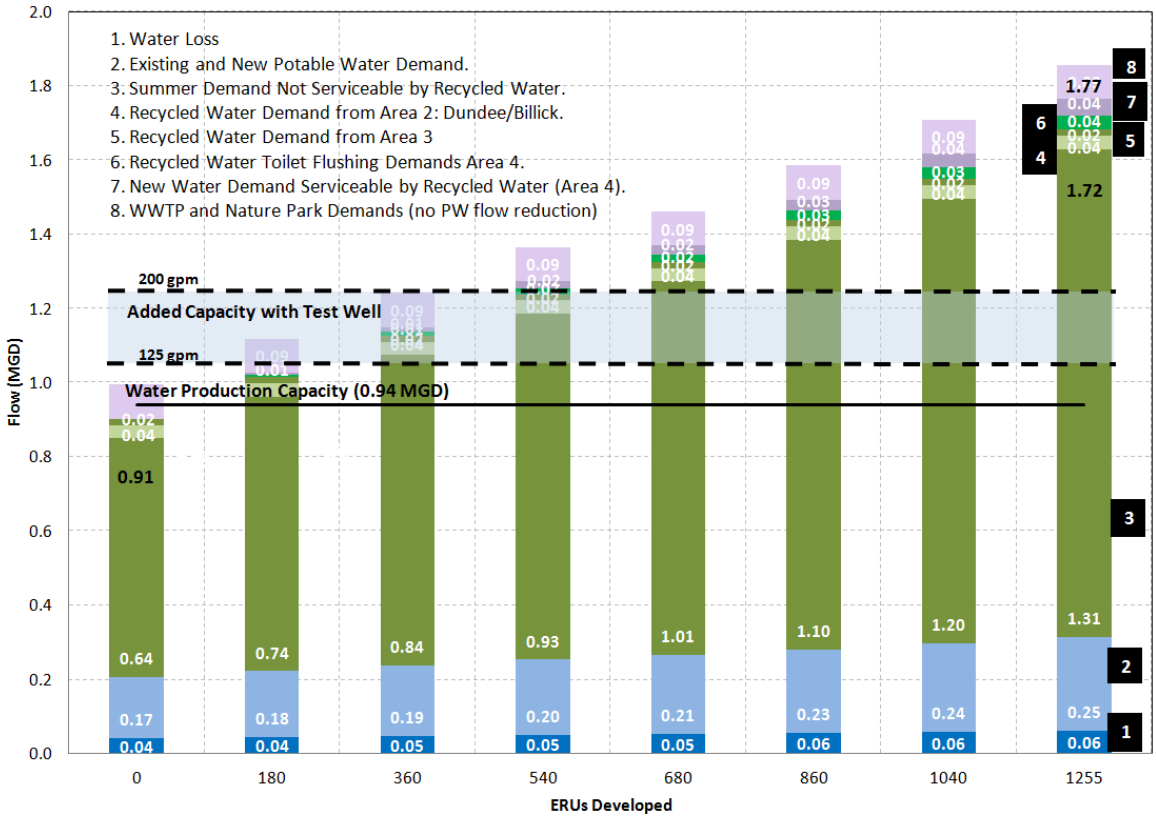

Figure 6.1: System Demands with Low Recycled Water Usage

Summary of Low Use Projections presented in Figure 6.1

- Recycled Water demands are assumed at 10% irrigation demands across developed areas.
- No recycled water service to Dundee/Billick School and Park.
- No recycled water service to Area 3.
- No recycled water service for toilet flushing in new developments.
- 0.94 MGD Capacity reached at approximately 50 ERUs.
- 1.22 MGD Capacity reached at approximately 525 ERUs.

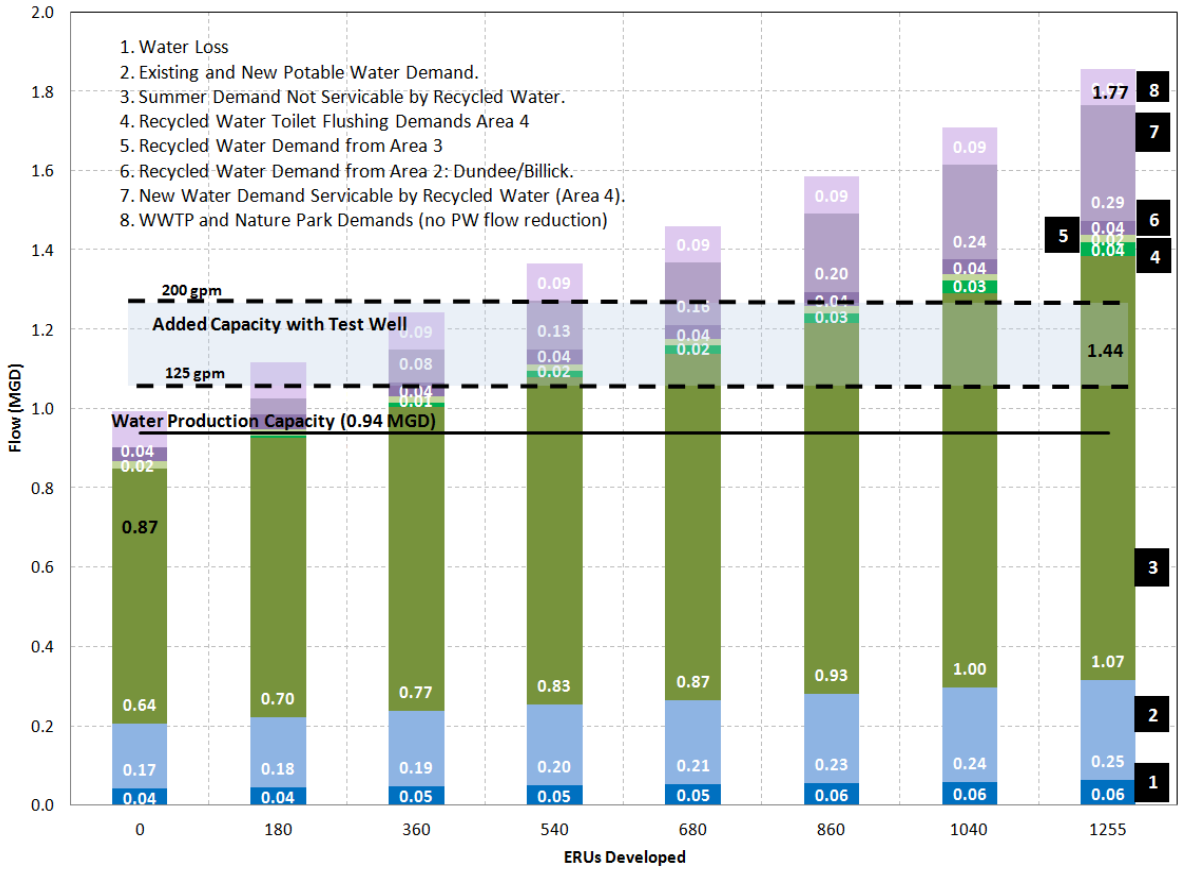

Figure 6.2: System Demands with Medium Recycled Water Usage

Summary of Medium Use Projections presented in Figure 6.2

- Recycled Water demands are assumed at 65% irrigation demands across developed areas.
- Recycled water service included to Dundee/Billick School and Park.
- No recycled water service to Area 3.
- No recycled water service for toilet flushing in new developments.
- 0.94 MGD Capacity reached at approximately 170 ERUs.
- 1.22 MGD Capacity reached at approximately 875 ERUs.

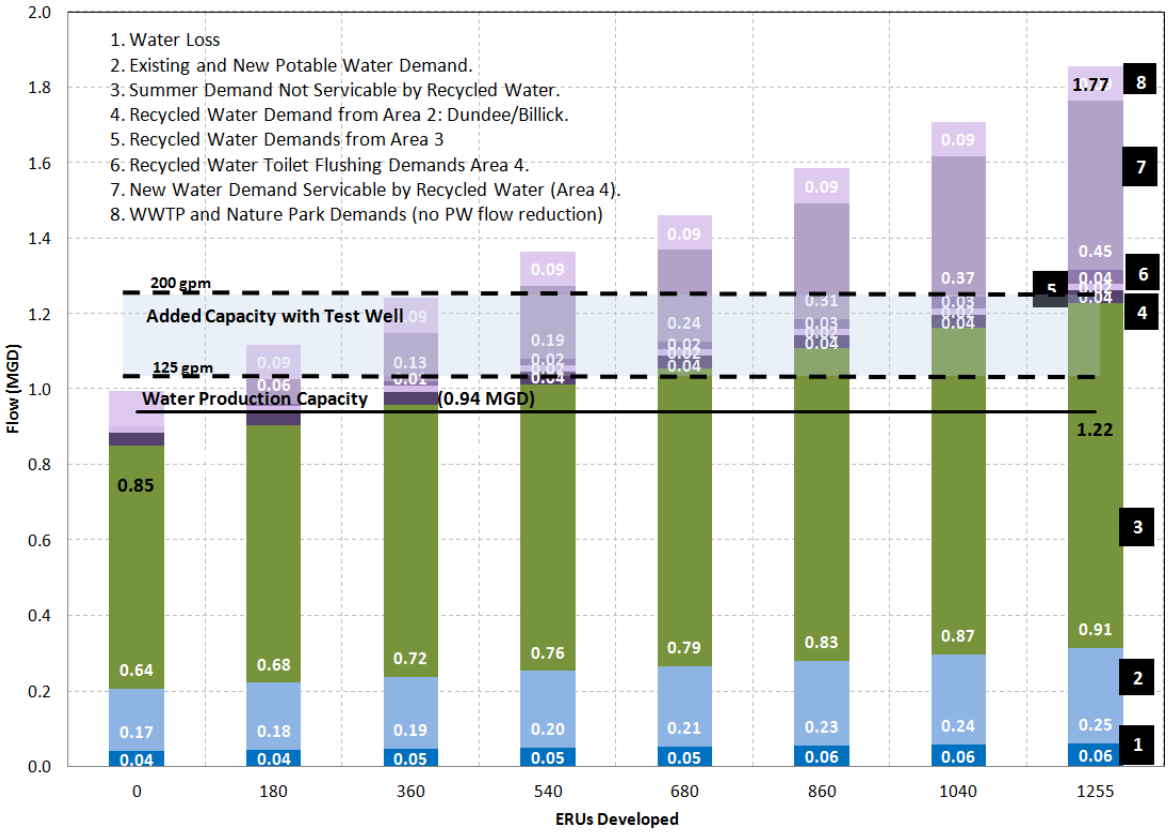

Figure 6.3: System Demands with High Recycled Water Usage

Summary of High Use Projections presented in Figure 6.3

- Recycled Water demands are assumed at 100% irrigation demands across developed areas.
- Recycled water service included to Dundee/Billick School and Park.
- Recycled water service included to Area 3.
- Recycled water service included for toilet flushing in new developments.
- 0.94 MGD Capacity reached at approximately 300 ERUs.
- 1.22 MGD Capacity reached at approximately 1255 ERUs.

6.2 Development of the Water Supply Portfolio

Implementation of the recycled water program has been shown to help reduce water supply issues; however, the extent that it can eliminate the water supply shortfall permanently is unlikely. Rather, the recycled water program creates another tool the City can utilize to address and manage the overall water supply issue. While the recycled water program can be a major contributor to decreasing the daily demands taxing the domestic water supply, implementation of other tools will help the City develop their 'Water Supply Portfolio.' This diversification will help decrease the overall reliance on any single supply. Other components of this portfolio may include water conservation efforts, and development of smaller capacity water production systems.

6.2.1 Conservation

The City recently completed a Water Management and Conservation Plan which provides recommendations to implement conservation strategies. The plan provides an overview of current consumption rates including per capita consumption relating total produced water and total system population provided below in Table 7.1. (Table 2-4 of the Water Management and Conservation Plan).

Table 6.1: Historical Water Demand Summary as taken from the Water Management and Conservation Plan

Table 2-4
Historical Water Demand Summary

Year	Service Area Population	Annual Total (MG)	Average Daily Demand (ADD)		Peak Season Demand (PSD)		Maximum Day Demand (MDD)	
			(mgd)	(gpcd)	(mgd)	(gpcd)	(mgd)	(gpcd)
2006	3,245	141.4	0.39	119	0.46	142	0.97	299
2007	3,277	132.8	0.36	111	0.41	125	0.91	278
2008	3,288	128.0	0.35	107	0.40	122	0.88	268
2009	3,299	127.8	0.35	106	0.39	118	0.88	267
2010	3,409[1]	122.1	0.33	98	0.57	167	0.92	270
2011	3,422	121.5	0.33	97	0.50	146	0.92	269
Average		128.9	0.35	106	0.46	136	0.91	275

Note: 1. The comparatively large increase in population between 2009 and 2010 is due to the data being obtained from different sources. Population growth has been consistent over the past 3 years.

Per capita data compiled by the League of Oregon Cities in their Water, Wastewater, and Stormwater Utility Rates and Charges 2009 Survey were compiled for other communities of similar characteristics and summarized in Table 6.2.

Table 6.2: Per Capita Consumption Data

Location	Population (2009)	Total Amount Treated in 2008 (mil. gal)	Peak Flow of Water Treated MGD	Capita (gallons/person/day)	
				Annual	Peak Flow
Amity	1,480	84	0.3	155	203
Carlton	1,755	134	0.6	209	342
Corvallis	54,880	2,770	16	138	292
Dayton	2,500	218	0.58	239	232
Florence	9,410	385	1.99	112	211
Gervais and Willamina	2,406	63	0.42	72	175
Lafayette	3,925	97	0.69	68	176
Molalla	7,590	301	2.2	109	290
Monmouth	9,565	599	1.5	172	157
Philomath	4,610	182	1.16	108	252
Reedsport	4,593	358	1.8	214	392
			Ave	**139**	**241**
City of Dundee	3,318	118[c]	0.84	98	253
Water Management and Conservation Plan				**106**	**275**
w/conservation	15%		0.78		234
	20%		0.73		220

Notes:
a) League of Oregon Cities, Water, Wastewater and Stormwater Utility Rates and Charges. 2009 Survey
b) Data per Dundee Water Management
c) 98.9 MGD metered * 1.20 (lost water assumed at 20%) = 118

Dundee per capita data provided above in Table 6.2 generally indicates the City is within an acceptable range of per capita demands. Of note, however, the locations shown to have higher peak flows tend to be larger service districts with a more diverse conglomerate of demand users. Generally, larger overall system per capita demands can result from greater proportions of commercial and industrial water users. While Dundee does have both these user groups, the water consumption of this smaller sect of users is not heavily impactful of the overall water demand. Therefore, the per capita flow factors for the City of Dundee may, in fact, be higher than otherwise expected or appropriate; i.e. per capita flow projections for Dundee may in fact be higher than generally considered acceptable.

For this purpose, the cities of Lafayette or Monmouth may better represent flow demands in line with what would be anticipated for Dundee, potentially indicating that a lower per capita peak flow demand could be attainable. Since Dundee's average per capita flow demands are lower than expected and what appears to be the average amongst the communities shown, the ratio between average and peak indicates there is significant peak consumption. Generally, the larger the ratio between average and peak consumption, there is more opportunity for conservation efforts to be effective.

6.2.2 Water Loss

The City is currently monitoring the water loss component of total water production. While the City is actively pursuing system losses, the current water loss as a percentage of total produced water has recently been well above the industry acceptable 10% threshold. Continual pursuit of water loss locations or events is a recommended and necessary component of the City's overall management of the water system.

6.2.3 Additional Water Production

Recycled water, water conservation, and reducing current water loss are all valuable tools the City should pursue to help alleviate peak day demand stresses on the system. All of these components will vary in how much direct reduction of potable water demands will be realized. While aggressive projections have shown that eliminating future production improvements is possible, a more conservative approach would warrant additional production capacity in order to bridge the gap between projected demands and available capacity – albeit offset by each of these demand reduction tools. Therefore, additional water production capacity may be necessary.

The City holds adequate water rights to expand their production capacity, including additional groundwater production wells or capitalizing on surface water rights. Potential capacity improvements could be developed through any of the water production possibilities currently available to the City, including perfecting current water rights, an additional production well, improved and permitted additional production out of the current test well, or pursuit of surface water intake and treatment.

6.3 Summary of Water Cycle 'Portfolio'

By incorporating these other demand reducing pursuits, Figure 6.4 was generated and depicts a revised water demand projection. The figure uses the medium usage baseline but includes the benefits of decreasing the lost water throughout the system to 10% and incorporates 15% water conservation across the system during max day demand periods (summer season). As shown, this comprehensive portfolio plan projects the current water supply plus the additional capacity provided by the test well can likely meet the expected buildout of the Riverside area.

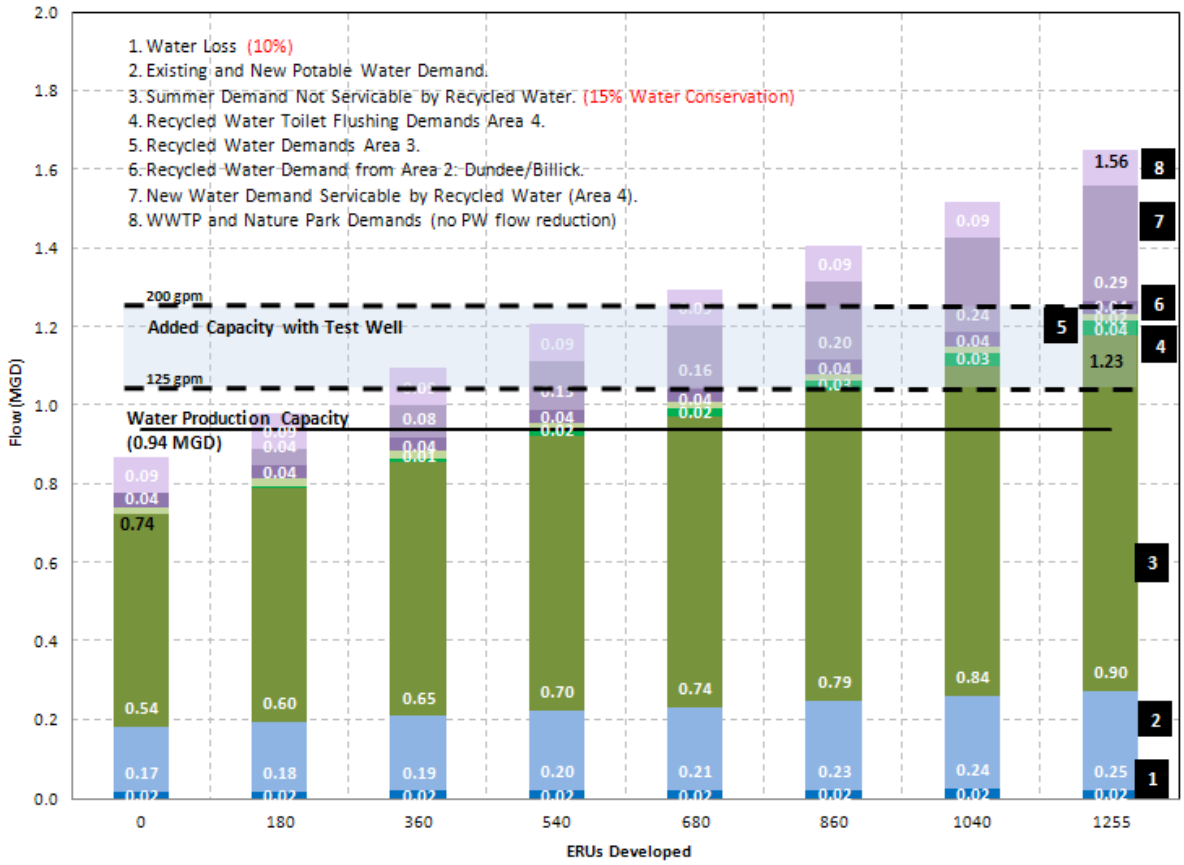

Figure 6.4: Water Demand Projections Incorporating Demand Reduction Portfolio Tools

Summary of Portfolio in Figure 6.4

- Recycled Water demands are assumed at 65% irrigation demands across developed areas.
- Recycled water service included to Dundee/Billick School and Park.
- No recycled water service to Area 3.
- No recycled water service for toilet flushing in new developments.
- Water conservation reduces potable demands by 15%
- Reduced water loss to 10%

6.4 Feasibility Analysis

As described in Section 2.4, the methodology for the feasibility analysis for the purposes of this project has been defined as the ability to augment the potable water system by providing recycled water for allowable uses, namely irrigation, to decrease the maximum day demands on the potable water system, thereby offsetting or delaying water supply improvements.

The feasibility analysis was defined as:

Project is Feasible (Positive):
Total Water Demand – Recycle Water Demand – Other Consumption Reductions < Future Potable Water Supply

Project is not Feasible (Negative):
Total Water Demand – Recycle Water Demand – Other Consumption Reductions > Future Potable Water Supply

The feasibility analysis was applied to the Portfolio approach. A summary of this analysis by number of added ERUs is shown below and indicates the Portfolio approach is feasible through the projected ERUs.

Table 6.3: Feasibility Analysis

New ERUs	Total Water Demand (MGD)	Recycled Water Demand (MGD)	Other Consumption Reductions (MGD)	Total Water Demand – RW Demand- Other Consumption (MGD)	Future Water Supply Capacity (MGD)	Feasibility Threshold
0	0.90	0.04	0.12	0.74	1.23	Positive
180	1.03	0.08	0.14	0.81	1.23	Positive
360	1.15	0.12	0.15	0.88	1.23	Positive
540	1.27	0.16	0.16	0.95	1.23	Positive
680	1.37	0.19	0.17	1.01	1.23	Positive
860	1.49	0.23	0.18	1.08	1.23	Positive
1040	1.62	0.28	0.19	1.15	1.23	Positive
1255	1.76	0.33	0.21	1.23	1.23	Positive

6.5 Cost Analysis

Many currently undefined factors will contribute to the allowable utility rate, including an estimation of the expected timing of development, the aggressiveness in which the City pursues implementation of the recycled water program, the extent and costs of water supply improvements, and ultimately the user accepted utility rate for the program. In order to better quantify these inputs, continue discussions with end users, and more formally address the tolerable utility rate, a complete rate study is recommended.

Capital costs associated with implementing the recycled water program were presented above. In addition to these fixed costs, annual operations and maintenance costs will be incurred. These include recommended maintenance sinking funds for reservoir recoating, routine pump and pipeline repairs and maintenance.

Net present worth evaluation for the recycled water system including capital and O&M costs was completed using Lifecycle Cost metrics presented in Section 2. The estimated NPW of the system is approximately $3,270,000.

6.6 Recommended Plan

All areas considered provide a reduction of potable water supply; however, the cost to implement service to each of these areas varies significantly. Outlying areas requiring long supply piping installations decreases the cost effectiveness of the installation. This is especially apparent for service to the Highway 99 properties and the Falcon Crest park location. Therefore, the implementation of the recycled water program and its feasibility is recommended to focus on initially serving Areas 1 and 2, the WWTP and Dundee/Billick School and Park, followed by developer connections. Future connections, serving the Area 3 users, should be considered as a long term potential, however, given the relatively small recycled water demands and the high installation costs, they are not included in Recommended Plan. This Recommended Plan is schematically presented in Figure 6.5

In serving these two areas, the City trims current peak demands at one of the largest water consumers at Dundee/Billick School and implements a backbone pipe alignment that facilitates future developer connections.

These efforts decrease the current peak water system demands, but more importantly, begin the implementation of a recycled water program to ensure the City is able to accommodate developer connections. It is in these development connections and serving individual ERU irrigation demands where significant reduction in peak flow demands can be captured. While individually, these residential connections may not significantly attribute to city wide demands, as Figure 3.1 attests, the sum of residential connections contributes the majority of the summer irrigation demand.

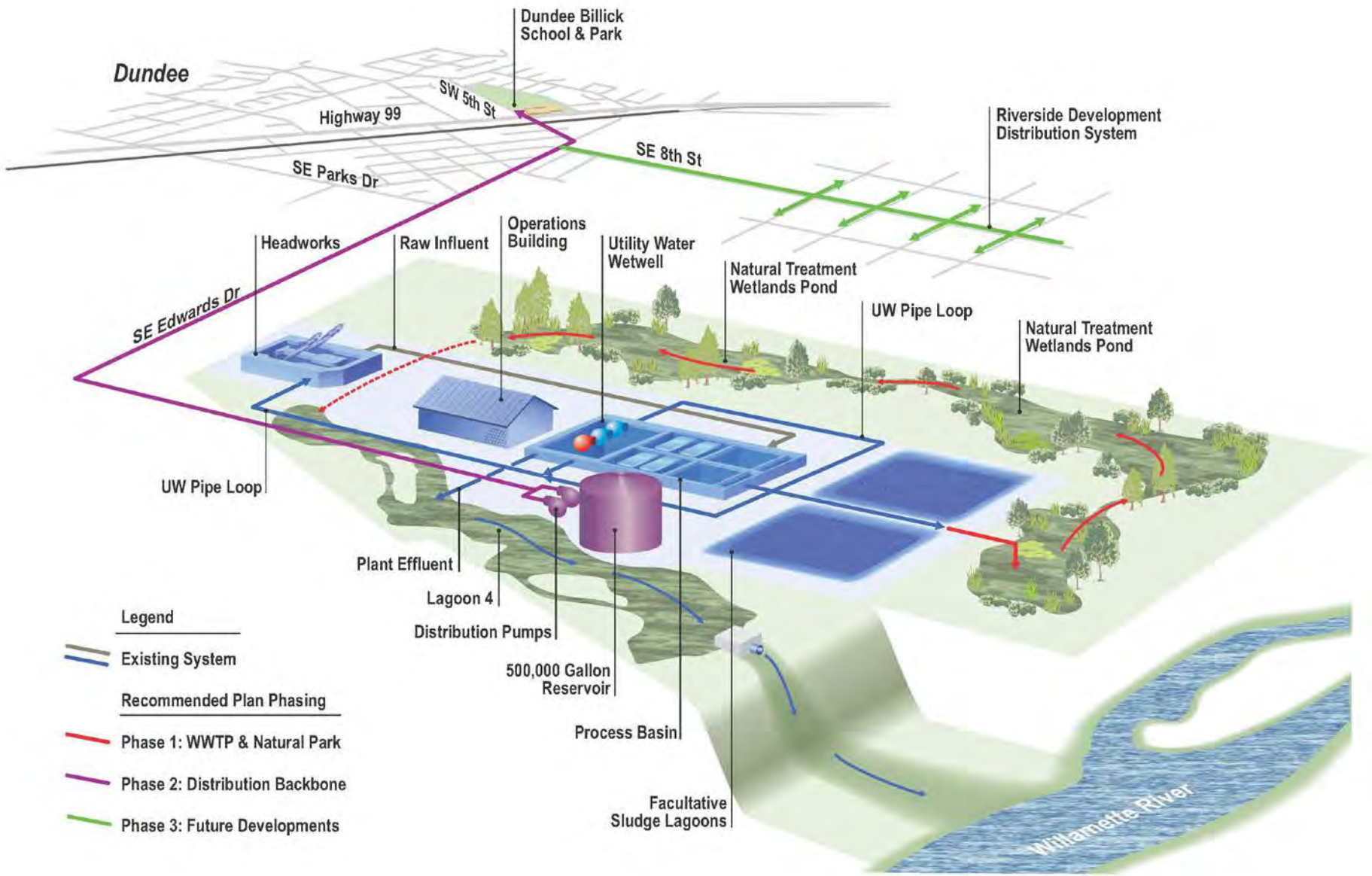

Figure 6.5: Recommended Plan Schematic

Section 7: Conclusions, Recommendations, and Next Steps

This section summarizes the conclusions, recommendations and next steps resulting from the Study as well as some suggestions for further analysis.

7.1 Conclusions

Dundee's water supply issue must be addressed if the developable area within the City is to be realized. While average day demands are well within the City's existing capacity, peak day demands during the summer irrigation season are near or at the City's current capacity. Through the implementation of a recycled water program, however, these peak demand periods heavily influenced by irrigation demands, can be shaved, prolonging the need for water supply expansion.

The feasibility of this plan is dependent upon the context and purpose in which the project is being evaluated. For this project, feasibility has been defined based on the ability of specific alternatives to decrease the potable water demands. Based on the user demands identified and the recommended plan to serve these demands, a reduction in potable demand is attainable and the feasibility found to be positive.

This Study has presented a range of available recycled water demands; however, the actual realized recycled water consumption will be heavily dependent on the level of commitment from both the City and its customers. While the City will need to consider their level of commitment and estimate their community's interest and involvement in order to best project expected consumption, for the purposes of answering the feasibility of this Study, a middle of the road approach was taken. Assuming the recycled water system would serve approximately 50% of the actual attainable recycled water demands, the City would be able to delay improvements to the water supply system until approximately 360 additional ERUs were added, a positive feasibility. The implementation of a recycled water system alone, however, is likely insufficient to delay these improvements indefinitely.

Short of a new surface water intake and treatment system, solving the City's water supply issue is not a going to be provided by a single solution. Rather, it is recommended that the City endeavor to develop a number of tools to help alleviate current peak demands while carving a plan forward to account for the expected development.

Implementation of this overall water supply portfolio approach positions the City for future growth to the east by facilitating developer connections to a recycled water program, helping instill public programs to conserve water and decrease current peak demands, and supporting the City's current pursuit of lost water. Through these efforts, the resulting potable water demands may be reduced enough to meet the demand shortcomings through smaller production vehicles such as additional wells rather than raw surface water treatment facilities.

7.2 Recommendations

It is recommended that the City pursue a rate analysis, including a user survey to help judge level of interest throughout the community. This process would help open the communication between the City and perspective users and should be used to continue building support for the program and to keep potential customers engaged in the development process. For example, additional information and questions regarding recycled water quality and quantity generated by the survey process could be used to form the outline of a City newsletter response. Also, since recycled water rates will be based on the water demand projections and capital cost estimates, these rates should be investigated with customers to determine if the water rates will meet the potential customers' expectations.

The City should develop a communication plan which will be critically important to ensure information and momentum is not lost as the City moves forward in their development of a recycled water program. This would help focus in the expected operating window and allow the feasibility calculations and NPW evaluations to be updated as assumptions are refined.

The City should continue to search for additional potential customers. Many future customers and demands likely exist that were not readily identified in this study. Contact and interviews should be conducted to establish relationships with these potential future customers. A marketing campaign to attract new businesses with large recycled water needs to the City could also be considered.

From a constructability standpoint, the railroad and ODOT Highway 99W crossings proposed along 5th Street will require additional investigation and, ultimately, permitting if the project is to proceed. It is recommended the City begin discussions with the railroad and ODOT and other agencies at such a time that a specific alternative is proposed for implementation, likely beginning with a more detailed follow-up investigation to develop the construction details that will be required.

Lastly, the City should begin discussions with Chehalem Park and Recreation District (CPRD) regarding irrigation of Dundee/Billick park with recycled water. The City should pursue an irrigation agreement with CPRD defining terms and conditions of recycled water use and supply.

7.3 Next Steps

- Update the City's Water System Master Plan:
  - Incorporate recycled water flows and demands established in this feasibility study;
  - Address service to the Riverside Area; define service pressures, distribution criteria, required fire flow:
  - Create hydraulic model to evaluate current and future water distribution system;
  - Address high system pressures in the lower distribution system; and
  - Develop a recommended Capital Improvement Program for existing and future water system including renewal and replacement pipeline projects;
  - Develop financing options, rates, and the necessary system development charges associated with the recycled water utility.

- Begin to consider policy and implementation framework including development of a Recycled Water Utility.
- Create Development Standards and update Public Works Standards to incorporate recycled water details and installation requirements.
- Conduct a formal rate study, including a user survey to help define level of interest throughout the community and a customer acceptable utility rate.
- Continue to pursue additional potential customers. Other recycled water demands may be available throughout the City. Typically, as these types of programs are developed, more users and demands can be categorized.
- Implement the other components of the 'Water Supply Portfolio' including conservation measures, continued pursuit of lost water, and securing the transferred water rights for the test well.

Appendix A

Oregon Recycled Water Beneficial Use Chart

Recycled Water Beneficial Purposes

Beneficial Purpose	Class A	Class B	Class C	Class D	Nondisinfected
Irrigation					
Fodder, fiber, seed crops not intended for human ingestion, commercial timber	Yes	Yes	Yes	Yes	Yes
Firewood, ornamental nursery stock, Christmas trees	Yes	Yes	Yes	Yes	No
Sod	Yes	Yes	Yes	Yes	No
Pasture for animals	Yes	Yes	Yes	Yes	No
Processed food crops	Yes	Yes	Yes	No	No
Orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil	Yes	Yes	Yes	No	No
Golf courses, cemeteries, highway medians, industrial or business campuses	Yes	Yes	Yes	No	No
Any agricultural or horticultural use	Yes	No	No	No	No
Parks, playgrounds, school yards, residential landscapes, other landscapes accessible to the public	Yes	No	No	No	No
Industrial, Commercial, or Construction					
Industrial cooling	Yes	Yes	Yes	No	No
Rock crushing, aggregate washing, mixing concrete	Yes	Yes	Yes	No	No
Dust control	Yes	Yes	Yes	No	No
Nonstructural fire fighting using aircraft	Yes	Yes	Yes	No	No
Street sweeping or sanitary sewer flushing	Yes	Yes	Yes	No	No
Stand alone fire suppression systems in commercial and residential buildings	Yes	Yes	No	No	No
Non-residential toilet or urinal flushing, floor drain trap priming	Yes	Yes	No	No	No
Commercial car washing	Yes	No	No	No	No
Fountains when the water is not intended for human consumption	Yes	No	No	No	No

Beneficial Purpose	Class A	Class B	Class C	Class D	Nondisinfected
Impoundments or Artificial Groundwater Recharge					
Water supply for landscape impoundments including, but not limited to, golf course water ponds and non-residential landscape ponds	Yes	Yes	Yes	No	No
Restricted recreational impoundments	Yes	Yes	No	No	No
Nonrestricted recreational impoundments including, but not limited to, recreational lakes, water features accessible to the public, and public fishing ponds	Yes	No	No	No	No
Artificial groundwater recharge	Yes	No	No	No	No

Appendix B

City of Dundee NPDES Waste Discharge Permit

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
Western Region – Salem Office
750 Front Street NE, Suite 120, Salem, OR 97301-1039
Telephone: (503) 378-8240
Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

ISSUED TO:

Dundee, City of
PO Box 220
Dundee, OR 97115

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Phase I		
Treated Wastewater	001	R.M. 51.7
Phase II		
Treated Wastewater	001	R.M. 52.1
Recycled Water Reuse	002	Irrigation

FACILITY TYPE AND LOCATION:

Phase I
Stabilization Lagoons without Aeration
Phase II
Membrane Bioreactor (MBR) Activated Sludge
City of Dundee
520 SW 5th Street, Dundee, OR 97115
Dundee, Oregon

Treatment System Class: Level I*
Collection System Class: Level II
*See Schedule D, Condition 5

RECEIVING STREAM INFORMATION:

Basin: Willamette
Sub-Basin: Middle Willamette
Receiving Stream: Willamette River
Hydro Code: 1227618456580 52.1 D
County: Yamhill

EPA REFERENCE NO: OR002338-8
Issued in response to Application No. 983751 received January 30, 2004. This permit is issued based on the land use findings in the permit record.

Steve Schnurbusch, Acting Water Quality Manager
Western Region

August 8, 2011
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Page
Schedule A - Waste Discharge Limitations not to be Exceeded 2
Schedule B - Minimum Monitoring and Reporting Requirements 6
Schedule D - Special Conditions 10
Schedule F - General Conditions 13

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge of waste is prohibited, including discharge to waters of the state or an underground injection control system.

SCHEDULE A

1. **Waste Discharge Limitations not to be exceeded after permit issuance during operation of the existing Facultative Lagoon treatment plant.**

a. Treated Effluent Outfall 001

(1) June 1 - October 31: No discharge to waters of the State is permitted

(2) November 1 – May 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	30 mg/L	45 mg/L	130	200	260
TSS	50 mg/L	80 mg/L	220	330	440

* Average dry weather design flow to the facility equals 0.273 MGD. Mass load limits based upon the monthly average discharge rate of 0.526 MGD.

(3)

Other parameters (year-round)	Limitations
E. coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL. (See Note 1)
pH	Shall be within the range of 6.0 - 9.0
BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and 65% monthly for TSS.

(4) No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR 340-041 applicable to the Willamette basin except as provided for in OAR 340-045-0080 and the following regulatory mixing zone:

The allowable mixing zone is that portion the Willamette River where the effluent mixes with 25 percent of the stream flow but in no case will it extend further than 50 feet from the point of discharge toward midstream and extending from a point ten feet upstream of the outfall to a point 100 feet downstream from the outfall. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within ten feet of the point of discharge.

(5) Groundwater

No activities shall be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater.

2. **Waste Discharge Limitations not to be exceeded 60 days after the permittee has completed construction of the Membrane Bioreactor (MBR) treatment facility.**

a. Treated Effluent Outfall 001

(1) May 1-October 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	10 mg/L	10 mg/L	27	41	54
TSS	10 mg/L	10 mg/L	27	41	54

*The design average dry weather flow of the facility is 0.52 MGD. The summer mass load limits are based on what the facility can achieve and the two year return flow of 0..648 MGD.

(2) November 1- April 30:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	30 mg/L	30 mg/L	130	200	260
TSS	30 mg/L	30 mg/L	130	200	260

*The winter mass load limits are based on the monthly average winter discharge flow rate of 0.526 MGD.

(3) Other Parameters

Year-round (except as noted)	Limitations
E. coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL (See Note 1).
pH	Shall be within the range of 6.0 - 9.0
BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and TSS.
UV Dose	Shall not be less than 30 mJ/cm^2 as a daily average (See Note 2)

(4) Except as provided for in OAR 340-045-0080, no wastes shall be discharged and no activities shall be conducted which violate Water Quality Standards as adopted in OAR 340-041-0445 except in the following defined mixing zone:

The allowable mixing zone is that portion of the Willamette River where the effluent mixes with 25 percent of the stream flow but in no case will it extend further than 50 feet from the point of discharge towards midstream and extending from a point ten feet upstream of the outfall to a point 100 feet downstream from the outfall. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within ten feet of the point of discharge.

(5) Chlorine and chlorine compounds shall not be used as a disinfecting agent of the treated effluent and no chlorine residual shall be allowed in the discharged effluent due to chlorine used for maintenance purposes.

b. Recycled Wastewater Outfall 002

No direct discharge of recycled water to state waters is permitted. Recycled water shall be treated to the appropriate level and reused for the following beneficial purposes:

Level of Treatment	Beneficial Purpose	Alternative Approval?
Class C	Any purpose allowed by OAR 340-055 for Class C recycled water	No
Class B	Any purpose allowed by OAR 340-055 for Class B recycled water	No
Class A	Any purpose allowed by OAR 340-055 for Class A recycled water	No

(1) All recycled water use distributed on land for dissipation by evapotranspiration and controlled seepage shall follow sound irrigation practices so as to prevent:

- Prolonged ponding of treated recycled water on the ground surface;
- Surface runoff or subsurface drainage through drainage tile;
- The creation of odors, fly and mosquito breeding or other nuisance conditions;
- The overloading of land with nutrients, organics, or other pollutant parameters; and,
- Impairment of existing or potential beneficial uses of groundwater.

(2) Prior to use, the Class C recycled water shall receive at least Class C treatment as defined in OAR 340-055 to:

Oxidize and disinfect so as not to exceed a 7 day median of 23 Total Coliform organisms per 100 mL and 240 Total Coliform per 10 mL in any two consecutive samples.

(3) Prior to use, the Class B recycled water shall receive at least Class B treatment as defined in OAR 340-055 to:

Oxidized and must reduce Total Coliform to a 7-day median of 2.2 organisms per 100 mL and a maximum of 23 organisms per 100 mL.

(4) Prior to use, the Class A recycled water shall receive at least Class A treatment as defined in OAR 340-055 to:

Oxidized, filtered, and:

Prior to disinfection, turbidity must not exceed an average of 2 nephelometric turbidity units (NTUs) within a 24-hour period, 5 NTUs more than five percent of the time within a 24-hour period and 10 NTUs at any time.

The UV Dose shall not be less than 80 mJ/cm^2 as a daily average (See Note 2)

After disinfection, Total Coliform must not exceed a median of 2.2 organisms per 100 mL based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 mL in any single sample.

(5) All use of recycled water shall conform to the Recycled Water Use Plan approved by the Department. Upon approval of the Recycled Water Use Plan, the Plan shall become enforceable through this permit action

c. Raw sewage discharges are prohibited.

d. No activities shall be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals shall be managed and disposed in a manner that will prevent a violation of Groundwater Quality Protection Rules (OAR 340-040).

e. Septage must not be accepted at this facility for treatment or processing without written approval from the Department.

NOTES:

1. If a single sample exceeds 406 organisms per 100 mL, then five consecutive re-samples may be taken at four-hour intervals beginning within 28 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation shall not be triggered.

2. The UV Dose shall be a calculation based on UV Intensity and average daily flow.

SCHEDULE B

1. **Quality Assurance/Quality Control**

The permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the permittee to analyze samples shall have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results shall be included in the report, but not used in calculations required by this permit. When possible, the permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

2. **Minimum Monitoring and Reporting Requirements during operation of the existing Facultative Lagoon treatment plant.**

a. Influent

The facility influent grab and composite samples and measurements are taken from the wet well at the influent pump station just before flowing into the primary lagoon cell.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annually	Verification
BOD_5	Weekly	Composite
TSS	Weekly	Composite
pH	2/Week	Grab

b. Treated Effluent Outfall 001

The facility effluent grab and composite samples and measurements are taken from just after the chlorine contact chamber and prior to flowing into the outfall pipeline.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annual	Verification
BOD_5	Weekly	Composite
TSS	Weekly	Composite
pH	2/Week	Grab
E. coli	Weekly	Grab
Quantity Chlorine Used	Daily	Measurement
Total Chlorine Residual	Daily	Grab
Pounds Discharged (BOD_5 and TSS)	Weekly	Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation

3. **Minimum Monitoring and Reporting Requirements after the permittee has completed construction of the Membrane Bioreactor (MBR) treatmeut facility.**

a. Influent

The facility influent grab and composite samples and measurements are taken just prior to mixing with plant return flows and flowing through the influent fine screens.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annually	Verification
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab

b. Treated Effluent Outfall 001

The facility effluent grab and composite samples and measurements are taken just after the UV disinfection chamber and flow meter and just prior to discharge to Lagoon Pond 4. Temperature measurements will be just prior to discharge from Lagoon Pond 4.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annual	Verification
BOD_5	2Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab
E. coli	Weekly	Grab
Ammonia (NH3-N)	Weekly	Composite (See Note 1)
Iron	Monthly	Composite (See Note 1)
Pesticides (Aldrin, DDT, DDT Metabolite, Dieldrin)/PCB	Semi-Annually during November and April	Composite (See Note 1)
UV Radiation Intensity	Daily	Reading (See Note 2)
UV Radiation Dose	Daily	Reading (See Note 2)
Turbidity	Hourly	Measurement
Pounds Discharged (BOD_5 and TSS)	Weekly	Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation
Temperature:		
Effluent Temperature, Daily Maximum	Daily	Continuous

c. Recycled Wastewater Outfall 002 (When using Class A, B, or C recycled water)

Item or Parameter	Minimum Frequency	Type of Sample
Flow Meter Calibration	Annually	Verification
Total Flow	Daily	Measurement
Quantity Irrigated (inches/acre)	Daily	Measurement
pH	3/Week	Grab
Total Coliform-Class C	3/Week	Grab
Total Coliform-Class B	3/Week	Grab
Total Coliform-Class A	Daily	Grab
Nutrients (TKN, NO_2+NO_3-N, NH_3, Total Phosphorus)	Weekly (May-Oct.)	Grab
UV Radiation Dose	Daily	Reading (See Note 2)
Turbidity*	Hourly	Measurement

*Turbidity monitoring will only apply to Class A recycled water reuse.

d. Facultative Sludge Lagoon Management

Item or Parameter	Minimum Frequency	Type of Sample
Sludge Depth in Cell #1	Annually	Representative Measurement
Sludge Depth in Cell #2	Annually	Representative Measurement
Sludge analysis including: Total Solids (% dry wt.) Volatile solids (% dry wt.) Biosolids nitrogen for: NH_3-N; NO_3-N; & TKN (% dry wt.) Phosphorus (% dry wt.) Potassium (% dry wt.) pH (standard units) Sludge metals content for: As, Cd, Cu, Hg, Mo, Ni, Pb, Se, & Zn, measured as total in mg/kg.	Each occurrence of sludge removal. (Analysis must be performed and reported to the Department no later than six (6) months prior to dredging the lagoons),	Composite sample to be representative of the product to be land applied from the Lagoons.
Record of locations where biosolids are applied on each DEQ approved site. (Site location maps to be maintained at treatment facility for review upon request by DEQ)	Each Occurrence	Date, volume & locations where sludge has been applied and recorded on site location map.

2. **Reporting Procedures**

a. Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to the appropriate Department office by the 15th day of the following month.

b. State monitoring reports shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports shall also identify each system classification as found on page one of this permit.

c. Monitoring reports shall also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

d. As per Schedule F in this permit, the permittee is required to submit five day written reports regarding Sanitary Sewer Overflow (SSO) events. Such reports are to be developed using the form entitled "SSO Reporting Form" which is available on DEQ's external website. The Department may waive the submittal of the five day written report on a case-by-case basis. After filling out the form, permit holders should print it out, sign it, and mail it to the appropriate regional office.

3. **Report Submittals**

a. The permittee shall have in place a program to identify and reduce inflow and infiltration into the sewage collection system. An annual report shall be submitted to the Department by February 1 each year which details sewer collection maintenance activities that reduce inflow and infiltration. The report shall state those activities that have been done in the previous year and those activities planned for the following year.

b. By no later than 15 January of each year that recycled water is generated and used, the permittee shall submit to the Department an annual report describing the effectiveness of the recycled water system to comply with the approved Recycled Water Use Plan, the rules of Division 55, and the limitations and conditions of this permit applicable to the reuse of recycled water. One copy of the annual report shall be submitted to the regional DEQ office; a second copy will be submitted to the DEQ Reuse Water Coordinator.

c. For any year in which biosolids are land applied, a report shall be submitted to the Department by February 19 of the following year that describes solids handling activities for the previous year and include, but is not limited to, the required information outlined in OAR 340-050-0035(6)(a0(e).

NOTES:

1. During the first year after start up of the new facility, monitoring for ammonia, iron and pesticides shall be performed on the effluent at Outfall 001 at the frequency specified above. The method detection limit for iron must be lower than 0.3 mg/L. After the first year, ammonia, iron and pesticide monitoring of the effluent may be eliminated unless otherwise notified in writing by the Department. If necessary, the Department may reopen the permit to incorporate permit limits.

2. The intensity of UV radiation passing through the water column will affect the systems ability to kill organisms. To track the reduction in intensity, the UV disinfection system must include a UV intensity meter with a sensor located in the water column at a specified distance from the UV bulbs. This meter will measure the intensity of UV radiation in mWatts/cm^2. The daily UV radiation intensity shall be determined by reading the meter each day. If more than one meter is used, the daily recording will be an average of all meter readings each day. The UV Dose shall be calculated based on UV Intensity and average daily flow.

SCHEDULE D

Special Conditions

1. Six months prior to the removal of accumulated solids from the lagoons, the permittee shall submit to the Department a biosolids management plan developed in accordance with Oregon Administrative Rule 340, Division 50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

2. All biosolids shall be managed in accordance with the DEQ approved biosolids management plan (submitted in accordance with Condition 1, above), and the site authorization letters issued by the DEQ. Any changes in solids management activities that significantly differ from operations specified under the approved plan require the prior written approval of the DEQ.

   All new biosolids application sites shall meet the site selection criteria set forth in OAR 340-050-0070 and must be located within Yamhill County. Property owners adjacent to any newly approved application sites shall be notified, in writing or by any method approved by DEQ, of the proposed activity prior to the start of application. For proposed new application sites that are deemed by the DEQ to be sensitive with respect to residential housing, runoff potential or threat to groundwater, an opportunity for public comment shall be provided in accordance with OAR 340-050-0030.

3. The decommissioning of the existing wastewater lagoons shall be approved by the Department thirty (30) days prior to the removal of any solids from the lagoons. The removal of accumulated solids from the existing lagoons shall be in accordance with OAR 340-050, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage".

4. This permit may be modified to incorporate any applicable standard for biosolids use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for biosolids use or disposal is more stringent than any requirements for biosolids use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

5. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification <u>and</u> grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit.

Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.

   b. The permittee's wastewater system may not be without supervision (as required by Special Condition 5.a. above) for more than thirty days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified at no less than one grade lower than the system classification.

   c. If the wastewater system has more than one daily shift, the permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

   d. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

e. The permittee shall notify the Department of Environmental Quality in writing within thirty days of replacement or re-designation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 2020 SW 4th Avenue, Suite 400, Portland OR. 97201., OR 97058. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

f. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor as required by 5.b. above.

6. Upon start up of the new MBR facility, the permittee will have personnel certified by the Department in the operation of the new higher Class III treatment facility in accordance with Condition 5, above.

7. The permittee shall meet the requirements for use of recycled water under Division 55, including the following:

a. No recycled water shall be released by the permittee until a Recycled Water Use Plan is approved by the Department.

b. All recycled water shall be managed in accordance with the approved Recycled Water Use Plan. No substantial changes shall be made in the approved plan without written approval of the Department.

c. The permittee shall notify the Department within 24 hours if it is determined that the treated effluent is being used in a manner not in compliance with OAR 340-055. When the Department offices are not open, the permittee shall report the incident of noncompliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

d. No recycled water shall be made available to a person proposing to recycle unless that person certifies in writing that they have read and understand the provisions in these rules. This written certification shall be kept on file by the sewage treatment system owner and be made available to the Department for inspection.

8. Recycled water used by a wastewater treatment system owner for landscape irrigation or for in plant processes at a wastewater treatment system is exempt from the rules of this division if:

a. The recycled water is an oxidized and disinfected wastewater;

b. The recycled water is used at the wastewater treatment system site where it is generated or at an auxiliary wastewater or sludge treatment facility that is subject to the same NPDES or WPCF permit as the wastewater treatment system. Contiguous property to the parcel of land upon which the treatment system is located is considered the wastewater treatment system site if under the same ownership;

c. Spray or drift or both from the use does not occur off the site; and

d. Public access to the site is restricted.

9. The permittee shall not be required to perform a hydrogeologic characterization or groundwater monitoring during the term of this permit provided:

a. The facilities are operated in accordance with the permit conditions, and;

b. There are no adverse groundwater quality impacts (complaints or other indirect evidence) resulting from the facility's operation.

If warranted, at permit renewal the Department may evaluate the need for a full assessment of the facilities impact on groundwater quality.

10. The permittee must notify the appropriate DEQ Western Region - Office in accordance with the response times noted in the General Conditions of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the DEQ. Warranted incidents of noncompliance/spills should be reported to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

SCHEDULE F

NPDES GENERAL CONDITION – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit
The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and the federal Clean Water Act and is grounds for an enforcement action. Failure to comply is also grounds for the Department to terminate, modify and reissue, revoke, or deny renewal of a permit.

2. Penalties for Water Pollution and Permit Condition Violations
The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions 33 USC §1365. DEQ enforcement is generally based on provisions of state statutes and EQC rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows the Department to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit. The federal Clean Water Act provides for civil penalties not to exceed $32,500 and administrative penalties not to exceed $11,000 per day for each violation of any condition or limitation of this permit.

Under ORS 468.943, unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense. The federal Clean Water Act provides for criminal penalties of not more than $50,000 per day of violation, or imprisonment of not more than 2 years, or both for second or subsequent negligent violations of this permit.

Under ORS 468.946, a person who knowingly discharges, places, or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state is subject to a Class B felony punishable by a fine not to exceed $200,000 and up to 10 years in prison. The federal Clean Water Act provides for criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment of not more than 3 years, or both for knowing violations of the permit. In the case of a second or subsequent conviction for knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

3. Duty to Mitigate
The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee must correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply
If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application must be submitted at least 180 days before the expiration date of this permit.

The Department may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions
This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute
b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge
d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a Total Maximum Daily Load (TMDL)
e. New information or regulations
f. Modification of compliance schedules
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions
i. Determination that the permitted activity endangers human health or the environment
j. Other causes as specified in 40 CFR 122.62, 122.64, and 124.5

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants
The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rules (OAR) 340-041-0033 and 307(a) of the federal Clean Water Act for toxic pollutants, and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights and Other Legal Requirements
The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other private rights, or any infringement of federal, tribal, state, or local laws or regulations.

8. Permit References
Except for effluent standards or prohibitions established under Section 307(a) of the federal Clean Water Act and OAR 340-041-0033 for toxic pollutants, and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

9. Permit Fees
The permittee must pay the fees required by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance
The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Activity Not a Defense
For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities
   a. Definitions
      (1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b. and c. of this section.
      (2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
   b. Prohibition of bypass.
      (1) Bypass is prohibited and the Department may take enforcement action against a permittee for bypass unless:
         i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
         ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
         iii. The permittee submitted notices and requests as required under General Condition B.3.c.
      (2) The Department may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Department determines that it will meet the three conditions listed above in General Condition B.3.b.(1).
   c. Notice and request for bypass.
      (1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to the Department at least ten days before the date of the bypass.
      (2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset
   a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.
   b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
   c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
      (1) An upset occurred and that the permittee can identify the causes(s) of the upset;
      (2) The permitted facility was at the time being properly operated;
      (3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and,
      (4) The permittee complied with any remedial measures required under General Condition A.3 hereof.
   d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Upset
   For purposes of this permit, A Single Operational Upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident

that causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational upset does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational upset is a violation.

6. Overflows from Wastewater Conveyance Systems
   a. Definitions
      (1) "Overflow" means any spill, release or diversion of municipal sewage including:
         i. An overflow that results in a discharge to waters of the United States; and
         ii. An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.
   b. Reporting required. All overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5. Reports concerning storm related overflows must include information about the amount and intensity of the rainfall event causing the overflow.

7. Public Notification of Effluent Violation or Overflow
   If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entitles (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed in accordance with General Condition B.8. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Emergency Response and Public Notification Plan
   The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:
   a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
   b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
   c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
   d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
   e. Provide emergency operations; and
   f. Ensure that DEQ is notified of the public notification steps taken.

9. Removed Substances
   Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling
   Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points may not be changed without notification to and the approval of the Department.

2. Flow Measurements
Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected must be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures
Monitoring must be conducted according to test procedures approved under 40 CFR part 136, or in the case of sludge use and disposal, under 40 CFR part 503, unless other test procedures have been specified in this permit.

4. Penalties of Tampering
The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both.

5. Reporting of Monitoring Results
Monitoring results must be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee
If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR part 136, or in the case of sludge use and disposal, under 40 CFR part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value must be recorded unless otherwise specified in this permit.

7. Averaging of Measurements
Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records
Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR part 503). Records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit and records of all data used to complete the application for this permit shall be retained for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of the Department at any time.

9. Records Contents
Records of monitoring information must include:

a. The date, exact place, time, and methods of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry
The permittee must allow the Department or EPA upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and
d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

11. Confidentiality of Information
Any information relating to this permit that is submitted to or obtained by DEQ is available to the public unless classified as confidential by the Director of DEQ under ORS 468.095. The Permittee may request that information be classified as confidential if it is a trade secret as defined by that statute. The name and address of the permittee, permit applications, permits, effluent data, and information required by NPDES application forms under 40 CFR 122.21 will not be classified as confidential. 40 CFR 122.7(b).

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes
The permittee must comply with OAR chapter 340, division 52, "Review of Plans and Specifications" and 40 CFR Section 122.41(l) (1). Except where exempted under OAR chapter 340, division 52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by the Department. The permittee must give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance
The permittee must give advance notice to the Department of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3. Transfers
This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit may be transferred to a third party without prior written approval from the Department. The Department may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under 40 CFR Section 122.61. The permittee must notify the Department when a transfer of property interest takes place.

4. Compliance Schedule
Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting
The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.

(1) Oral Reporting within 24 hours.

i. The following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311:

a) The location of the overflow;
b) The receiving water (if there is one);
c) An estimate of the volume of the overflow;
d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and
e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:

a) The OERS incident number along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:

a) The OERS incident number;
b) The cause or suspected cause of the overflow;
c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:

i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
ii. Any upset that exceeds any effluent limitation in this permit;
iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:

i. A description of the noncompliance and its cause;
ii. The period of noncompliance, including exact dates and times;
iii. The estimated time noncompliance is expected to continue if it has not been corrected;
iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
v. Public notification steps taken, pursuant to General Condition B.7

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. Other Noncompliance

The permittee must report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports must contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;
c. The estimated time noncompliance is expected to continue if it has not been corrected; and
d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information
The permittee must furnish to the Department within a reasonable time any information that the Department may request to determine compliance with the permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee must also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to the Department, it must promptly submit such facts or information.

8. Signatory Requirements
All applications, reports or information submitted to the Department must be signed and certified in accordance with 40 CFR Section 122.22.

9. Falsification of Information
Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $100,000 per violation and up to 5 years in prison. Additionally, according to 40 CFR 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

10. Changes to Indirect Dischargers
The permittee must provide adequate notice to the Department of the following:
a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;
b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

SECTION E. DEFINITIONS

1. *BOD* means five-day biochemical oxygen demand.
2. *CBOD* means five day carbonaceous biochemical oxygen demand.
3. *TSS* means total suspended solids.
4. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
5. *FC* means fecal coliform bacteria.
6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR Section 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR Chapter 340, Division 41.
8. *mg/l* means milligrams per liter.
9. *kg* means kilograms.

10. *m^3/d* means cubic meters per day.
11. *MGD* means million gallons per day.
12. 24-hour *Composite sample* means a combination of at least six discrete sample aliquots of at least 100 milliliters, collected at periodic intervals from the same location, during the operating hours of the facility over a 24 hour period. Four (rather than six) aliquots should be collected for volatile organics analyses. The composite must be flow or time proportional, whichever is more appropriate. The sample aliquots must be collected and stored in accordance with procedures prescribed in the most recent edition of *Standard Methods for the Examination of Water and Wastewater.*
13. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
14. *Quarter* means January through March, April through June, July through September, or October through December.
15. *Month* means calendar month.
16. *Week* means a calendar week of Sunday through Saturday.
17. *POTW* means a publicly owned treatment works.

Appendix C

Cost Estimate Evaluations

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: **2013 City of Dundee Recycle Water Feasibility Study - Area 1:WWTP**

Level of Estimate **Feasibility (Conceptual)**

Prepared By: JLH

Date Prepared: 3-Apr-13

K/J Proj. No.: 0991005.30

			Materials		Installation		
Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework							
HMAC Demo	-	YD^2	$0.00	$0	$6.90	$0	$0
Excavation	200	YD^3	$0.00	$0	$7.00	$1,400	$1,400
Hauling	200	YD^3	$0.00	$0	$2.09	$418	$418
3/4"-0 Crushed Base Rock (with compaction)	200	YD^3	$30.50	$6,100	$12.18	$2,436	$8,536
HMAC Pavement	-	YD^2	$12.40	$0	$1.33	$0	$0
Subtotal Div 2							**$10,354**
DIV 15 - Mechanical							
6" PVC C900 Pipe	350	FT	$10.27	$3,594	$8.12	$2,843	$6,436
6" DI Fittings	6	EA	$400.00	$2,400	$300.00	$1,800	$4,200
6" DI Butterfly Valve	3	EA	$1,000.00	$3,000	$500.00	$1,500	$4,500
3/4" Meter and Meter Vault	1	EA	$1,000.00	$1,000	$300.00	$300	$1,300
Subtotal Div 15							**$16,436**
TOTALS							**$26,790**
	Contractor General Conditions @	6%					$1,607
	Contractor OH&P @	10%					$2,679
	Contingency @	30%					$8,037
	Engineering, Legal, Admin	30%					$8,037
	Estimated Project Cost						**$48,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: **2013 City of Dundee Recycle Water Feasiblity Study - Storage and Pumping**
Level of Estimate **Feasibility (Conceptual)**

Prepared By: JLH
Date Prepared: 3-Apr-13
K/J Proj. No.: 0991005.30

			Materials		Installation		
Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework							
Reservoir Excavation	100	YD^3	$0.00	$0	$7.00	$700	$700
3/4"-0 Crushed Base Rock (with compaction)	100	YD^3	$15.00	$1,500	$17.00	$1,700	$3,200
Pile Foundation	25	piles	$2,000.00	$50,000	$5,000.00	$125,000	$175,000
Concrete Reservoir Foundation	110	YD^3	$400.00	$44,000	$300.00	$33,000	$77,000
Subtotal Div 2							**$255,900**
DIV 15 - Mechanical							
Bolted Steel Reservoir	500,000	Gallons	$1.00	$500,000	$0.20	$100,000	$600,000
40 HP Centrifugal Pump	2	Each	$30,000.00	$60,000	$20,000.00	$40,000	$100,000
8" DI Piping - Onsite	200	LF	$30.00	$6,000	$20.00	$4,000	$10,000
8" Plug Valve	2	Each	$1,200.00	$2,400	$500.00	$1,000	$3,400
8" Check Valve	2	Each	$1,500.00	$3,000	$600.00	$1,200	$4,200
8"C900 Distribution Piping	350	LF	$5.55	$1,943	$4.39	$1,537	$3,479
Subtotal Div 15							**$721,079**
DIV 16&17 - E&IC							
Electrical and Instrumentation	20	%					**$195,396**
TOTALS							**$1,172,375**
Contractor General Conditions @	6%						$70,342
Contractor OH&P @	10%						$117,237
Contingency @	30%						$351,712
Engineering, Legal, Admin	30%						$351,712
Estimated Project Cost							**$2,060,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: **2013 City of Dundee Recycle Water Feasiblity Study -Nature Park**

Level of Estimate **Feasibility (Conceptual)**

Prepared By: MDH

Date Prepared: 29-May-13

K/J Proj. No.: 0991005*30

				Materials		Installation		
	Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework								
	Lagoon Shaping, Cut and Fill	50000	LS	$0	$0	$2	$100,000	$100,000
	Bentonite Clay Liner + Soil Tilling	25000	SY	$5	$125,000	$1	$12,500	$137,500
	Pond Liner Compaction (after tilling of bentonite)	8250	CY	$0	$0	$4	$28,875	$28,875
	Pedestrian Gravel Walkway	1185	CY	$15	$17,778	$15	$17,778	$35,556
	Plantings	13	Acres	$15,000	$195,000	$5,000	$65,000	$260,000
	Irrigation System	1	LS	$75,000	$75,000	$25,000	$25,000	$100,000
	Subtotal Div 02							**$661,931**
DIV 11 - Equipment								
	Control Structures	2	EA	$8,000	$16,000	$1,600	$3,200	$19,200
	Subtotal Div 11							**$19,200**
DIV 15 - Mechanical								
	6" PVC C900 Pipe	100	FT	$10	$1,027	$8	$812	$1,839
	Subtotal Div 15							**$1,839**
TOTALS								
	Subtotal							**$683,000**
	Contractor Mobilization @	6%						$41,000
	Contractor OH&P @	10%						$68,300
	Contingency @	30%						$204,900
	ELA @	30%						$204,900
	Estimated Construction Cost							**$1,202,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: **2013 City of Dundee Recycle Water Feasiblity Study - Area 2: City Hall**

Level of Estimate **Feasibility (Conceptual)**

Prepared By: JLH
Date Prepared: 3-Apr-13
K/J Proj. No.: 0991005.30

			Materials		Installation		
Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework							
HMAC Demo	1,296	YD^2	$0.00	$0	$6.90	$8,944	$8,944
Excavation	2,593	YD^3	$0.00	$0	$7.00	$18,148	$18,148
Hauling	2,593	YD^3	$0.00	$0	$2.09	$5,419	$5,419
3/4"-0 Crushed Base Rock (with compaction)	2,415	YD^3	$30.50	$73,646	$12.18	$29,410	$103,056
HMAC Pavement	1,296	YD^2	$12.40	$16,074	$1.33	$1,724	$17,798
ODOT Coordination	1	LS					$15,000
Traffic Control	1	LS					$10,000
Subtotal Div 2							**$178,365**
DIV 15 - Mechanical							
8" PVC C900 Pipe	7,000	FT	$15.17	$106,190	$9.71	$67,988	$174,178
8" DI Fittings	25	EA	$500.00	$12,500	$400.00	$10,000	$22,500
8" DI Butterfly Valve	14	EA	$1,200.00	$16,800	$600.00	$8,400	$25,200
1" Meter and Meter Vault	1	EA	$1,200.00	$1,200	$400.00	$400	$1,600
Subtotal Div 15							**$223,478**
TOTALS							**$401,843**
Contractor General Conditions @	6%						$24,111
Contractor OH&P @	10%						$40,184
Contingency @	30%						$120,553
Engineering, Legal, Admin	30%						$120,553
Estimated Project Cost							**$710,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: **2013 City of Dundee Recycle Water Feasiblity Study - Area 3A: Fortune Park** **Prepared By:** JLH

Level of Estimate **Feasibility (Conceptual)** **Date Prepared:** 3-Apr-13

K/J Proj. No.: 0991005.30

			Materials		Installation		
Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework							
HMAC Demo	167	YD^2	$0.00	$0	$6.90	$1,150	$1,150
Excavation	333	YD^3	$0.00	$0	$7.00	$2,333	$2,333
Hauling	333	YD^3	$0.00	$0	$2.09	$697	$697
3/4"-0 Crushed Base Rock (with compaction)	310	YD^3	$30.50	$9,469	$12.18	$3,781	$13,250
HMAC Pavement	167	YD^2	$12.40	$2,067	$1.33	$222	$2,288
Subtotal Div 2							**$19,718**
DIV 15 - Mechanical							
6" PVC C900 Pipe	900	FT	$10.27	$9,241	$8.12	$7,309	$16,550
6" DI Fittings	5	EA	$400.00	$2,000	$300.00	$1,500	$3,500
6" DI Butterfly Valve	2	EA	$1,000.00	$1,800	$500.00	$900	$2,700
3/4" Meter and Meter Vault	1	EA	$1,000.00	$1,000	$300.00	$300	$1,300
Subtotal Div 15							**$24,050**
TOTALS							**$43,769**
	Contractor General Conditions @	6%					$2,626
	Contractor OH&P @	10%					$4,377
	Contingency @	30%					$13,131
	Engineering, Legal, Admin	30%					$13,131
	Estimated Project Cost						**$80,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: **2013 City of Dundee Recycle Water Feasiblity Study - Area 3B: Highway 99**
Level of Estimate **Feasibility (Conceptual)**

Prepared By: JLH
Date Prepared: 3-Apr-13
K/J Proj. No.: 0991005.30

			Materials		Installation		
Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework							
HMAC Demo	130	YD^2	$0.00	$0	$6.90	$894	$894
Excavation	259	YD^3	$0.00	$0	$7.00	$1,815	$1,815
Hauling	259	YD^3	$0.00	$0	$2.09	$542	$542
3/4"-0 Crushed Base Rock (with compaction)	241	YD^3	$30.50	$7,365	$12.18	$2,941	$10,306
HMAC Pavement	130	YD^2	$12.40	$1,607	$1.33	$172	$1,780
ODOT Coordination	1	LS					$15,000
Traffic Control	1	LS					$10,000
Subtotal Div 2							**$40,337**
DIV 15 - Mechanical							
6" PVC C900 Pipe	700	FT	$10.27	$7,187	$12.00	$8,400	$15,587
6" DI Fittings	8	EA	$400.00	$3,200	$300.00	$2,400	$5,600
6" DI Butterfly Valve	4	EA	$1,000.00	$4,000	$500.00	$2,000	$6,000
3/4" Meter and Meter Vault	2	EA	$1,000.00	$2,000	$300.00	$600	$2,600
Subtotal Div 15							**$29,787**
TOTALS							**$70,124**
Contractor General Conditions @	6%						$4,207
Contractor OH&P @	10%						$7,012
Contingency @	30%						$21,037
Engineering, Legal, Admin	30%						$21,037
Estimated Project Cost							**$130,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: **2013 City of Dundee Recycle Water Feasiblity Study - Area 3C: Falcon Crest Park**

Level of Estimate **Feasibility (Conceptual)**

Prepared By: JLH

Date Prepared: 3-Apr-13

K/J Proj. No.: 0991005.30

			Materials		Installation		
Description	**Qty**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
DIV 02 - Sitework							
HMAC Demo	981	YD^2	$0.00	$0	$6.90	$6,772	$6,772
Excavation	1,963	YD^3	$0.00	$0	$7.00	$13,741	$13,741
Hauling	1,963	YD^3	$0.00	$0	$2.09	$4,103	$4,103
3/4"-0 Crushed Base Rock (with compaction)	1,828	YD^3	$30.50	$55,761	$12.18	$22,268	$78,028
HMAC Pavement	981	YD^2	$12.40	$12,170	$1.33	$1,305	$13,476
Subtotal Div 2							**$116,119**
DIV 15 - Mechanical							
8" PVC C900 Pipe	5,300	FT	$15.17	$80,401	$9.71	$51,476	$131,877
8" DI Fittings	20	EA	$500.00	$10,000	$400.00	$8,000	$18,000
8" DI Butterfly Valve	10	EA	$1,200.00	$12,000	$600.00	$6,000	$18,000
3/4" Meter and Meter Vault	1	EA	$1,000.00	$1,000	$300.00	$300	$1,300
Subtotal Div 15							**$169,177**
TOTALS							**$285,297**
Contractor General Conditions @	6%						$17,118
Contractor OH&P @	10%						$28,530
Contingency @	30%						$85,589
Engineering, Legal, Admin	30%						$85,589
Estimated Project Cost							**$510,000**

City of Dundee
Recycled Water Feasibility Study
Net Present Cost Evaluation

Period of Evaluation	20	Years
Discount Rate	3%	
Labor Rate Escalation	2%	per Year
Electricity Rate Escalation	2%	per Year
Labor Cost	$ 65,000	per FTE

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Labor Multiplier		1	1.02	1.04	1.06	1.08	1.10	1.13	1.15	1.17	1.20	1.22	1.24	1.27	1.29	1.32	1.35	1.37	1.40	1.43	1.46
Capital Cost																					
Area 1: WWTP	$ 48,000																				
Area 1A: Pumping and Storage	$ 2,060,000																				
Area 2: Dundee/Billick	$ 710,000																				
Area 3: Other City Properties	$ -																				
Total Recommended Plan Capital	**$ 2,818,000**																				
Present Worth Improvement Loan	**($3,049,000)**	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918	$ 204,918
Annual O&M Inputs																					
Area 1: Storage Recoating Sinking Fun	$ 1,600																				
Area 1 Pumping Operations	$ 3,000																				
Area 1: WWTP Piping Maintenance	$ 700																				
Area 2: Dundee/Billick Pipeline Mainten	$ 6,600																				
Pumping Energy Costs	$ 2,000																				
Total Recommended Plan Capital	**$ 12,300**																				
Present Worth Improvement Loan	**($218,000)**	$12,300	$12,546	$12,797	$13,053	$13,314	$13,580	$13,852	$14,129	$14,411	$14,700	$14,994	$15,294	$15,599	$15,911	$16,230	$16,554	$16,885	$17,223	$17,567	$17,919
20-Year NPW	**($3,267,000)**																				