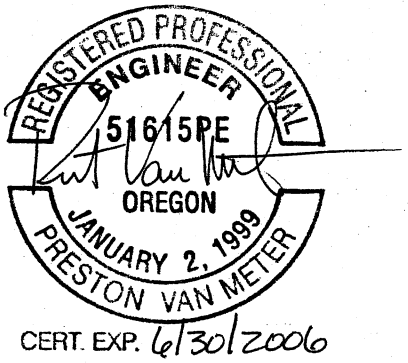
Hubbard WWTP

Alternate Discharge Alternatives Study



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Section 1: Introduction

1.1 Authority and Purpose

Kennedy/Jenks Consultants, Inc. (Kennedy/Jenks) was retained by the City of Hubbard (City) on 13 July 2004 to complete the Hubbard WWTP Alternate Discharge Alternatives Study (Discharge Study) .The purpose of this final report is to summarize Kennedy/Jenks evaluation of alternatives to meet future WWTP effluent limits for discharge to Mill Creek.

1.2 Background

The City of Hubbard has been verbally informed by the Oregon Department of Environmental Quality (DEQ) that the City's currently-allowed dry season discharge from May 1 through October 31 will likely be limited in the future by Oregon Administrative Rules (OAR) 340-041-0007(17)(A)(i), otherwise known as the Dilution Rule, OAR 340-041-0028 containing the Oregon Temperature Standard and the Molalla-Pudding Total Maximum Daily Load (TMDL) currently being prepared by DEQ.

The City of Hubbard is currently completing a major upgrade of the Hubbard WWTP to address several issues identified in the Hubbard WWTP Facilities Plan completed by BST, Inc in 2002 and amended by Kennedy/Jenks Consultants in a PreDesign Report completed in October 2004. The WWTP improvements include a new influent bypass structure, replacement of the influent screen, conversion of the Schreiber Counter-Current Aeration Basin to a Selector-Activate Sludge treatment process, addition of Aerobic Digester #3 and installation of a centrifuge for solids dewatering.

This Discharge Study provides a summary of regulatory issues associated with the Hubbard WWTP direct discharge to Mill Creek, alternatives to address the regulatory issues, the recommended alternative, conclusions and recommendations and a preliminary timeline for implementation of the recommended alternative.

Exhibit 1 is a Location Map showing the Hubbard WWTP and City Hall.

1.3 Report Organization

Following is an overview of sections included in this report.

Section 1 – Introduction & Background. An introduction to the project, including the authority and purpose, report organization, and references and acknowledgements. Section 1 also includes background information relating to the purpose of the project.

Section 2 – Regulatory Requirements. An overview of the current Hubbard WWTP NPDES Permit, Oregon narrative criteria relating to biochemical oxygen demand (BOD Rule), Oregon Division 55 reclaimed water regulations and the future Molalla-Pudding Total Maximum Daily Load (TMDL).

Section 3 – Methodology. A summary of the evaluation criteria and methodology used in the alternatives evaluation.

Section 4 – Alternatives. Summary of potential alternatives for meeting current and future regulatory requirements at the Hubbard WWTP. Alternatives evaluated include staged discharge to Mill Creek, construction of a new Pudding River outfall, subsurface discharge and reclaimed water irrigation.

Section 4 – Recommended Alternative. A matrix-based alternative evaluation based on the methodology presented in Section 3 and the recommended alternative.

Section 5 – Conclusions and Recommendations. A summary of conclusions, recommendations, and a preliminary timeline for implementation of the recommended alternative.

1.4 References

The following references were used in preparation of this report:

- Oregon Administrative Rules (OAR), Chapter 340-Divisions 40 (Groundwater Quality Protection), -Division 41 (Water Quality Standards), -Division 42 (Total Maximum Daily Loads), -Division 55 (Reclaimed Water Use).
- Hubbard Wastewater Treatment Plant Improvements Project Preliminary Design Report. Kennedy/Jenks Consultants, October 2004.
- 2005 Hubbard Wastewater Improvements Project Final Documents. Kennedy/Jenks Consultants, May 2005.
- Hubbard Wastewater Treatment Plant Facilities Plan. BST, March 2003.
- City of Hubbard Wastewater Treatment and Disposal Study. Boatwright Engineering, June 1983.
- Soil Survey of Marion County Area, Oregon. Soil Conservation Service, National Resources Conservation Service (NRCS), September 1972.

1.5 Acknowledgements

Kennedy/Jenks appreciates the cooperative input and support from City staff, including Vickie Nogle, Jaime Estrada, Rob Daykin, Mike Krebs and Melinda Olinger. Their cooperation, assistance, and valuable insight were very helpful in assuring the study methodology, conclusions, and recommendations are consistent with City of Hubbard goals and objectives.

Section 2: Regulatory Issues

The purpose of this section is to summarize regulatory requirements related to wastewater treatment and effluent discharge from the Hubbard Wastewater Treatment Plant, including:

- Mill Creek Summer Season Flows
- Flow and Temperature
- Hubbard WWTP NPDES Permit
- Oregon Water Quality Standards
- Molalla-Pudding Total Maximum Daily Load
- Oregon Reclaimed Water Regulations.

2.1 Mill Creek Flows and Temperatures

The Hubbard WWTP currently discharges year-round to Mill Creek, which is a small stream with low summer season flows. The summer season 7Q10 used by DEQ to develop NPDES Permit limits is 2.39 CFS (1.54 MGD). There is minimal available flow and temperature data available for Mill Creek. It is recommended that the City install a flow monitoring gauge and temperature gauges upstream and downstream of the Hubbard WWTP discharge and outfall.

The 7Q10 low flow used for calculating the NPDES Permit limits was used for the evaluations presented in this section. It should be noted that Mill Creek serves a large agricultural area upstream of Hubbard and the Hubbard WWTP discharge typically improves water quality in the creek. The historical exception has been brief periods with process upsets that are the focus of the Hubbard WWTP improvements project currently under construction. For the purposes of this report, Mill Creek flows were assumed to be the stated 7Q10 summer season low flow in the NPDES Permit due to the limited available historical flow data for Mill Creek.

2.2 Hubbard NPDES Waste Discharge Permit

The Oregon Department of Environmental Quality (DEQ) regulates the discharge of treated wastewater effluent through National Pollutant Discharge Elimination System (NPDES) and Water Pollution Control Facility (WPCF) permits. In general, NPDES permits are issued to wastewater facilities discharging directly to surface water bodies and WPCF permits to facilities with no direct surface water discharge. NPDES permits are issued to ensure WWTP compliance with Oregon Water Quality Standards included in Oregon Administrative Rules (OAR) Chapter 340, Division 41.

Requirements for NPDES and WPCF permits are contained in OAR Chapter 340, Division 45 (OAR 340-45). The purpose OAR 340-45 is to "prescribe limitations on discharge of wastes and the requirements and procedures for obtaining NPDES and WPCF permits from the Department (of Environmental Quality)."

The City's National Pollutant Discharge Elimination System (NPDES) Permit #101640 is currently in public review and will be issued in early 2006. A copy of the NPDES Permit, Fact Sheet and City comments on the Draft Permit are included in Appendix A.

Schedule A of the City's NPDES Permit contains waste discharge limitations for Outfall 001, the primary WWTP outfall to Mill Creek. The waste discharge limitations are summarized in Table 1.

Table 1: Outfall 001 NPDES Waste Discharge Limits [1]
City of Hubbard WWTP

Parameter	Monthly Average Concentration	Weekly Average Concentration	Monthly Average Load [2]	Weekly Average Load [2]	Daily Maximum Load [2]
Summer Season (May 1 through October 31)					
BOD_5	10 mg/L	15 mg/L	28 lb/day	42 lb/day	56 lb/day
TSS	10 mg/L	15 mg/L	28 lb/day	42 lb/day	56 lb/day
Excess Thermal Load [3,4]	Shall not exceed a weekly average of 1,000,000 Kcals/day				
Winter Season (November 1 through April 30)					
BOD_5	30 mg/L	45 mg/L	85 lb/day	130 lb/day	170 lb/day
TSS	30 mg/L	45 mg/L	85 lb/day	130 lb/day	170 lb/day
Other Parameters (year-round)					
E.Coli Bacteria	Shall not exceed 126 counts/100mL monthly geometric mean or 406 org/100mL for a single sample.				
pH	Shall be within range of 6.4 – 9.0.				
BOD_5 and TSS Monthly Average Removal Efficiency	Shall not be less than 85%.				
Excess Thermal Load (May 1 through October 31)	Shall not exceed a weekly average of 1.0 million Kcal/day				

Notes:

(1) From current Hubbard WWTP NPDES Permit #101640 for File Number 40494 dated 27 December 2005 with an expiration date of 31 December 2009.

(2) Mass load limits are based upon WWTP average dry weather design flow of 0.34 MGD.

(3) The Excess Thermal Load limit was calculated using the average dry weather design flow and an estimated maximum weekly effluent temperature. The Permittee shall comply with the excess thermal load limit upon completion of Schedule C, Condition 4 or by the expiration date of this permit, whichever is sooner. The Excess Thermal Load is considered interim and may be adjusted updown or eliminated when more accurate effluent temperature data becomes available. In addition, upon approval of a Total Maximum Daily Load for temperature in this sub-basin, this permit may be re-opened to include new or revised limits or other conditions or requirements regarding temperature and/or thermal loads.

(4) The Excess Thermal Load limit is based on a Mill Creek 7Q10 low flow of 2.39 cfs.

Abbreviations:

mg/L = milligrams per liter
lb/day = Pounds per day
Kcal/day = Kilocalories per day
org/100mL = organisms per 100 milliLiters

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2.2.1 Hubbard NPDES Permit Schedule C Compliance Schedules and Conditions

The following conditions and schedules are included in the City's NPDES Permit. Conditions 4 and 6 relate to compliance with the Molalla-Pudding TMDL and evaluation and development of a water reuse program for the Hubbard WWTP. It is anticipated that this Alternate Discharge Alternatives Study satisfies Condition 4. With regard to Condition 6 and according to the Oregon DEQ website, the Molalla-Pudding TMDL is currently targeted for completion in 2006.

1. By no later than 27 December 2006, the permittee shall submit either an engineering evaluation which demonstrates the design average wet weather flow, or a request to retain the existing mass load limits. The design average wet weather flow is defined as the average flow between November 1 and April 30 when the sewage treatment facilities' is projected to be at design capacity for that portion of the year. Upon acceptance by the Department of the design average wet weather flow determination, the permittee may request a permit modification to include higher winter mass loads based on the design average wet weather flow.

2. Within 180 days of permit modification to include higher winter mass load limits as specified in Condition 1 of this Schedule, the permittee shall submit to the Department for review and approval a proposed program and time schedule for identifying and reducing inflow. Within 60 days of receiving written Department comments, the permittee shall submit a final approvable program and time schedule. The program shall consist of the following:

   a. Identification of all overflow points and verification that sewer system overflows are not occurring up to a 24-hour, 5-year storm event or equivalent

   b. Monitoring of all pump station overflow points

   c. A program for identifying and removing all inflow sources into the permittee's sewer system over which the permittee has legal control

   d. If the permittee does not have the necessary legal authority for all portions of the sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.

3. By no later than 27 March 2006, the permittee shall submit to the Department a report which either identifies known sewage overflow locations and a plan for estimating the frequency, duration and quantity of sewage overflowing, or confirms that there are no overflow points. The report shall also provide a schedule to eliminate overflow(s), if any.

4. By no later than 31 October 2008, the permittee shall submit to the Department for approval, a report that evaluates the feasibility of land application alternatives to the summer discharge to Mill Creek.

5. By no later than 31 December 2009, the permittee shall submit to the Department for approval a data summary report. The data summary report shall contain but not be limited to

monitoring and sampling information and results from the effluent on temperature, toxics and dissolved oxygen.

6. By no later than six months after notification that the Total Maximum Daily Load (TMDL) has been approved, the permittee shall submit to the Department an evaluation of whether or not the treatment facilities can consistently comply with any Waste Load Allocation (WLA) and all other requirements of the TMDL and the permit. If the evaluation indicates the permittee is not able to consistently comply with the TMDL or this permit, the permittee shall complete the following schedule:

   a. By no later than one year after notification that the TMDL has been approved, the permittee shall submit to the Department for approval an evaluation of alternatives for facility improvements necessary to comply with the TMDL and this permit.

   b. By no later than two years after notification that the TMDL has been approved, the permittee shall submit to the Department for approval final engineering plans and specifications for any necessary improvements.

   c. By no later than three years after notification that the TMDL has been approved, the permittee shall submit documentation to the Department that contracts for construction of the necessary improvements have been awarded.

   d. By no later than four years after notification that the TMDL has been approved, the permittee shall complete construction of all necessary improvements and comply with the TMDL and this permit.

7. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than fourteen days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director may revise a schedule of compliance if he/she determines good and valid cause resulting from events over which the permittee has little or no control.

2.2.2 Hubbard WWTP NPDES Permit Compliance

The Hubbard WWTP has historically produced wastewater effluent in the summer season with Biochemical Oxygen Demand (BOD_5) less than 5 mg/l and Total Suspended Solids (TSS) less than 10 mg/l, except during periods with sludge storage or settling problems. It is anticipated the WWTP will consistently produce wastewater effluent with monthly average BOD_5 and monthly maximum BOD_5 of 5 mg/l and 7.0 mg/l, respectively. The anticipated TSS is anticipated to be consistently less than 5 mg/l under normal flow conditions.

Disinfection performance by ultraviolet (UV) irradiation ranges from non-detect to approximately 75 *E.coli* counts/100 ml for, but is typically less than 1 *E.coli* count/100ml. Episodes with higher E.*coli* counts have generally corresponded to sludge settling issues in the secondary process or solids storage capacity in the aerobic digesters. These two issues are being addressed with the 2005 WWTP Improvements Project, which should reduce the higher recorded *E.coli* counts in the future.

The excess thermal load in the NPDES Permit is an interim limit subject to re-opening for modification after completion of the Molalla-Pudding TMDL or other cumulative effects analysis. The interim excess thermal load in the Permit is 1,000,000 Kcal/day based on a weekly average of daily maximum effluent temperatures. Equations 1 and 2 are the governing equations used for calculating excess thermal loads by DEQ for effluent discharges to streams and rivers.

$$\Delta T = Q_{WWTP} * \frac{(T_{WWTP} - T_{RIVER})}{(Q_{WWTP} + Q_{RIVER})} \qquad \text{(Equation 1)}$$

$$H_{EXCESS} = \Delta T * (Q_{WWTP} + Q_{RIVER}) * (CF) \qquad \text{(Equation 2)}$$

Abbreviations in Equations 1 and 2 are:

H_{EXCESS}	= Excess Thermal Load from Hubbard WWTP to Mill Creek
ΔT	= Change in Mill Creek temperature at the regulatory mixing zone
Q_{WWTP}	= Hubbard WWTP discharge flow (cfs)
T_{WWTP}	= Hubbard WWTP discharge temperature (ºF)
Q_{RIVER}	= Mill Creek mixing zone flow defined as 25% of total flow (cfs)
T_{RIVER}	= Mill Creek ambient temperature (ºF)
CF	= Conversion Factors

Using Equations 1 and 2, the excess thermal load (H_{EXCESS}) from the Hubbard WWTP direct discharge to Mill Creek will be 11,600,000 kcal/day based on a Mill Creek flow (Q_{RIVER}) of 0.60 CFS (25% of Mill Creek 7Q10 low flow), Mill Creek Biological Criterion Temperature of 18 ºC (T_{RIVER}) and Hubbard WWTP discharge flow and temperature of 0.51 MGD and 24 *C, respectively, from the NPDES Permit Evaluation Report included in Appendix A. This indicates the Hubbard WWTP is unlikely to be able to meet the excess thermal load limit of 1,000,000 kcal/day Excess Thermal Load included in the NPDES Permit.

The current and projected 2025 Hubbard WWTP Maximum Month Dry Weather Flows (MMDWF) developed in the Hubbard Wastewater Treatment Plant Improvements Preliminary Design Report (2004 PreDesign Report) completed in October 2004 are 0.16 MGD and 0.22 MGD, respectively. According to WWTP Discharge Monitoring Reports (DMRs), the peak summer season effluent temperature is approximately 23ºC (73 ºF). Based on the MMDWF flow of 0.22 MGD and an effluent temperature of 23*C, H_{EXCESS} will be 4,200,000 kcal/day, which is still in excess of the 1,000,000 kcal/day Excess Thermal Load.

Kennedy/Jenks recommends the following with regard to NPDES Permit compliance:

- The City should request the Excess Thermal Load Limit be increased based on the design flow of 0.51 MGD and maximum effluent temperature of 24ºC.
- If the current Excess Thermal Load Limit of 1,000,000 kcal/day cannot be modified, the City should seek an implementation or compliance timeframe to be included in Schedule C of the NPDES Permit.

2.3 Oregon Water Quality Standards

Oregon Administrative Rules Chapter 340, Division 41 (OAR 340-41) contains water quality standards, beneficial uses, policies and criteria for Oregon. The Hubbard WWTP discharge

must comply with all related sections of OAR 340-41. Two specific standards likely to impact the Hubbard WWTP discharge to Mill Creek are:

- OAR 340-041-0007 State Wide Narrative Criteria – Dilution Rule
- OAR 340-041-0028 Oregon Temperature Standard

2.3.1 Dilution Rule

The "Dilution Rule" is contained in Section 0007(17)(A)(i) of OAR 340-41-0007 State Wide Narrative Criteria. The Dilution Rule states that *"effluent BOD concentrations in mg/l, divided by the dilution factor (ratio of receiving stream flow to effluent flow) may not exceed one unless otherwise approved by the commission."* The allowable WWTP discharge for a specified effluent BOD concentration and Mill Creek flow can be determined from the dilution rule based on Equation 3.

$$Q_{ALLOWABLE}\ (mgd) \leq \frac{Q_{CREEK}\ (mgd)}{BOD_{WWTP}\ (mg/l)} \qquad \text{(Equation 3)}$$

2.3.2 Hubbard WWTP Dilution Rule Compliance

A monthly summer season (May – October) Dilution Rule Evaluation for the Hubbard WWTP discharge to Mill Creek is included in Appendix D. Mill Creek flows are based on the summer 7Q10 low flow used by DEQ in the NPDES Permit of 2.39 cfs. Current Hubbard WWTP discharge flows are based on 2002-04 WWTP Discharge Monitoring Reports (DMRs). Projected 2025 flows are based on flow projections in the 2004 PreDesign Report.

Based on the Dilution Rule evaluation, it appears the current WWTP discharge exceeds the Dilution Rule allowable discharge under current conditions in July. By 2025, with the anticipated BOD_5 reduction resulting from the 2005 WWTP Improvements Project, the WWTP discharge will exceed the Dilution Rule allowable discharge in the months of June, July, August and September under maximum monthly flow conditions. However, anecdotal evidence of historical Mill Creek flows indicates there is typically adequate flow in Mill Creek in the first two weeks of June.

Kennedy/Jenks recommends the following with regard to Dilution Rule compliance:

- The City should monitor summer season BOD_5 in the Hubbard WWTP discharge after completion of the 2005 Hubbard WWTP Improvements Project.
- The City should install a flow meter upstream of Mill Creek to monitor flows over several years to confirm the 7Q10 low flow of 2.39 cfs.
- The Dilution Rule Evaluation for current and future conditions should be reviewed after more current and applicable BOD_5 and Mill Creek summer season flow data has been collected.

2.3.3 Oregon Temperature Standard

OAR 340-041-0028 contains Oregon water quality standards for Temperature (Temperature Standard) and establishes temperature goals for Oregon water bodies based on biological and spawning criteria for endangered salmonid species and other beneficial uses. Beneficial Uses for Willamette Basin streams are included in Appendix B. Biologically based numeric criteria (Biological Criteria) for Oregon water bodies are summarized on fish use maps included in the Temperature Standard.

The Temperature Standard contains four elements that regulate thermal discharges from municipal and industrial point sources like the Hubbard WWTP:

- **Biological Criteria.** Biologically Based Numeric Criteria are summarized on Fish Use Maps and establish the base temperature criteria for a stream unless superseded by the Natural Conditions Criteria.

- **Natural Conditions Criteria.** An evaluation of "natural conditions" in a water body, typically established through the TMDL process, may indicate that the natural thermal potential for the water body exceeds the Biological Criteria. In this case, the Natural Conditions Criteria supersedes the Biological Criteria for the period noted in the TMDL or other cumulative effects analysis prepared by DEQ.

- **Cold Water Protection.** The Temperature Standard includes winter anti-degradation provisions to protect cold waters during spawning periods. Spawning Use Maps included in the Temperature Standard designate water bodies with spawning grounds that are protected to prevent early fry emergence.

- **Human Use Allowance.** The Temperature Standard allows the *"insignificant"* addition of thermal load to water bodies associated with anthropogenic activities. The Human Use Allowance is 0.3 *C measured at either the Point of Maximum Impact or the edge of the regulatory mixing zone. The Point of Maximum Impact is undefined in the Temperature Standard, but is used when a water body has a Temperature TMDL, otherwise the thermal load is calculated at the edge of the regulatory mixing zone.

The Temperature Standard regulates point sources on the ambient temperature until the ambient temperature exceeds the applicable criterion temperature, in which case the point source is regulated based on the criterion temperature.

2.3.3.1 Biological Criteria

Figure 340A in Appendix C summarizes the designated fish uses for water bodies in the Willamette Basin. Based on Figure 340, Mill Creek is designated for "Salmon & Trout Rearing & Migration." The Biological Criteria for this Salmon and Trout Rearing and Migration is defined in OAR 340-041-0028(4)(c):

> *"The seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration use on subbasin maps set out at OAR 340–41-0101: …Figures 340A…, may not* exceed 18.0 degrees Celsius (64.4 degrees Fahrenheit)."

2.3.3.2 Natural Conditions Criteria

The Molalla-Pudding Temperature TMDL currently being completed by DEQ will determine if the natural thermal potential temperature exceeds the Biological Criteria. If the natural thermal potential temperature for Mill Creek exceeds the Biological Criteria, then the natural thermal potential temperature supersedes the Biological Criteria for the period specified in the TMDL.

The Molalla-Pudding TMDL is discussed in Section 2.3.

2.3.3.3 Cold Water Protection

Colder water temperatures are protected in the Temperature Standard for water bodies designated for salmon and steelhead spawning. Figure 340B in Appendix C summarizes the designated spawning reaches in the Willamette Basin. Figure 340B indicates Mill Creek is not designated for spawning and the cold water protection criteria do not apply.

2.3.3.4 Human Use Allowance

The Human Use Allowance providing for an allowable increase in stream temperatures from anthropogenic activities is based on whether a TMDL has been prepared for the discharge water body. If a TMDL has not been prepared, the Human Use Allowance is defined in OAR 340-041-0028(12)(b)(A):

> *"Prior to the completion of a temperature TMDL or other cumulative effects analysis, no single NPDES point source that discharges into a temperature water quality limited water body may cause the temperature of the water body to increase more than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after mixing with either twenty-five percent of the stream flow, or the temperature mixing zone, whichever is more restrictive."*

If a TMDL has been prepared for a water body, the Human Use Allowance is defined in OAR 340-041-0028(12)(b)(B):

> *"Following a temperature TMDL or other cumulative effects analysis, wasteload and load allocations will restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the applicable criteria after complete mixing in the water body and at a point of maximum impact."*

The "point of maximum impact" in Mill Creek will be determined as part of the Molalla-Pudding TMDL. However, based on precedent in the Willamette TMDL for tributaries to the Willamette River, it is assumed the Hubbard WWTP will be allocated an excess thermal load limit based on an allowable increase in Mill Creek temperature of 0.3 °C (0.5 °F) above Biological Criterion temperature of 18 °C (64.4 °F) at the edge of the WWTP regulatory mixing zone.

2.3.4 Hubbard WWTP Temperature Compliance

A monthly summer season (May – October) Temperature Standard Evaluation for the Hubbard WWTP discharge to Mill Creek is included in Appendix E. Mill Creek flows are based on the Mill Creek 7Q10 low flow because the only available flow data for Mill Creek was collected by the

Oregon Water Resources Department for the water year ending September 1981. Current Hubbard WWTP discharge flows are based on 2002-04 WWTP Discharge Monitoring Reports (DMRs). Projected 2025 flows are based on flow projections in the 2004 PreDesign Report.

Based on the Temperature Standard evaluation based on the applicable biological criteria, under current and future flow conditions, the WWTP discharge appears to exceed the Temperature Standard allowable discharge in the months of June, July, August and September. However, anecdotal evidence of historical Mill Creek flows indicates that there is typically adequate flow in Mill Creek in the first two weeks of June. Therefore, the most likely period with potential Temperature Standard issues is the last two weeks of June, July, August and September.

Important Note: The Temperature Standard Evaluation for current and future conditions is based on incomplete and antiquated data and should be reviewed with more current Mill Creek flow and temperature data and WWTP effluent temperatures after completion of the 2005 WWTP Improvements Project.

2.4 Molalla-Pudding Total Maximum Daily Load

The federal Clean Water Act of 1972 requires the State of Oregon (Oregon) to assess water quality in streams and rivers. CWA Section 305(b) requires Oregon to report on the overall status of water quality every two years and CWA Section 303(d) requires Oregon to prepare a list of water bodies failing to meet water quality standards and protect designated beneficial uses.

A Total Maximum Daily Load (TMDL) is required for water quality limited streams that fail to protect designated beneficial uses. A TMDL defines the maximum amount of a pollutant that can be present in a waterbody and meet State water quality standards. The Oregon Department of Environmental Quality (DEQ) is responsible for assessing water quality, maintaining the 303(d) List and preparing TMDLs for listed water quality impairments. TMDL requirements for Oregon are contained in OAR Division 42.

The Hubbard WWTP currently discharges directly to Mill Creek, which is part of the Molalla-Pudding Sub-Basin of the Willamette Basin. Mill Creek outlets into the Pudding River several miles downstream of Hubbard, which outlets to the Molalla River and, ultimately, the Willamette River. Exhibit 2 is a map showing Willamette Basin and Molalla-Pudding Sub-Basin rivers and streams. The Molalla-Pudding Subbasin TMDL covering the Molalla River, Pudding River and Mill Creek is currently scheduled for completion in 2006.

Following is a summary of the Willamette Basin designated beneficial uses, Pudding River 303(d) List and the Molalla-Pudding Sub-Basin TMDL currently being prepared by the DEQ.

2.4.1 Molalla-Pudding Basin Designated Beneficial Uses

OAR 340-041-0340 specifies designated beneficial uses to be protected in the Willamette Basin, including the Molalla River, Pudding River and Mill Creek. Table 340A included in Appendix B summarizes the designated beneficial uses for the Willamette Basin. The

designated beneficial uses for the Pudding River and Mill Creek are summarized in the "All Other Tributaries" column of Table 340 A, which includes:

- Public Domestic Water Supply
- Private Domestic Water Supply
- Industrial Water Supply
- Irrigation
- Livestock Watering
- Fish & Aquatic Life
- Wildlife & Hunting
- Fishing
- Boating
- Water Contact Recreation
- Aesthetic Quality
- Hydro Power

While many of these designated beneficial uses may not pertain specifically to Mill Creek near the Hubbard WWTP discharge, they do represent the beneficial uses to be protected on all tributaries in the Willamette Basin. Designated beneficial uses for a specific segment of a water body can be removed through a Use Attainability Analysis (UAA).

2.4.2 Pudding River 303(d) List

The Pudding River 303(d) List of water quality impairments is summarized in Table 2. Mill Creek is not listed, but is assumed to be subject to the same limitations as the Pudding River.

Table 2: Pudding River 303(d) List

Parameter	1998 303(d) List	2002 303(d) List	Season
Temperature	X	X	Summer
Fecal Coliform	X		Year Around
DDT	X		Year Around

2.4.3 Hubbard WWTP TMDL Compliance

Point source discharges in a TMDL are prescribed wasteload allocations to address water quality impairments included in the 303(d) List. The Molalla-Pudding Subbasin TMDL is currently being completed by the DEQ. Probable Hubbard WWTP wasteload allocations to be included in the TMDL will be for temperature and fecal coliform.

Disinfection at the Hubbard WWTP is provided through a Trojan Ultraviolet (UV) disinfection facility. To meet NPDES requirements, the treatment plant monitors E.Coli organisms in the WWTP effluent. The discharge consistently meets permit requirements. Therefore, it is

assumed the WWTP discharge would consistently meet a wasteload allocation for fecal coliform included in the Molalla-Pudding Subbasin TMDL.

Temperature is likely to be the biggest issue for the WWTP discharge to Mill Creek, as previously discussed. Since the Temperature TMDL is currently being prepared by DEQ, it is assumed that a thermal wasteload allocation for the Hubbard WWTP discharge will be based on biological criteria prescribed in the Oregon Temperature Standard. Use of the biological criteria is considered a worst case scenario from a river temperature standpoint, since use of the natural conditions criteria through a TMDL would indicate the biological criteria cannot be attained.

2.5 Oregon Reclaimed Water Regulations

The DEQ regulates Oregon's reclaimed water standards through Oregon Administrate Rules, Chapter 340, Division 55 (OAR 340-55), regulating effluent treatment and allowable uses for reclaimed water in Oregon. The purpose of OAR 340-55 is to "protect the environment and public health in Oregon by prescribing the methods, procedures, and restrictions required for the use for beneficial purposes of reclaimed water." A copy of OAR 340-55 is included in Appendix F.

OAR 340-55 establishes four "levels" of reclaimed water quality with buffering requirements and allowable uses for each level. Each level of reclaimed water quality has specified treatment requirements, including effluent limits for Total Coliform bacteria and Turbidity. Table 1 contained in OAR 340-55-015 summarizes the treatment, monitoring and allowable uses for reclaimed water in Oregon. Table 3 below summarizes the effluent quality standards and monitoring requirements for Oregon Level II, III and IV reclaimed water.

Table 3: Oregon Reclaimed Water Standards (OAR 340-55)
Effluent Quality Standards

Parameter	Level II Reclaimed Water	Level III Reclaimed Water	Level IV Reclaimed Water
Total Coliform (Organisms/100mL)			
Two Consecutive Samples	240	No Limit	No Limit
7-day Median	23	2.2	2.2
Maximum	No Limit	23	23
Sampling Frequency	1 per week	3 per week	daily
Turbidity (NTU)			
24-hour Mean	No Limit	No Limit	2
5% of time during 24-hour period	No Limit	No Limit	5
Sampling Frequency	Not Required	Not Required	Hourly

Allowable uses of reclaimed water are also included in OAR 340-55. The allowable uses and buffer requirements change depending on the level of reclaimed water quality produced. Table 4 summarizes required buffers and allowable uses for Level II, III and IV reclaimed water in Oregon.

Table 4: Oregon Reclaimed Water Standards (OAR 340-55) Allowable Uses & Buffers

Parameter	Level II Reclaimed Water	Level III Reclaimed Water	Level IV Reclaimed Water
Buffers			
Buffers for Irrigation	Surface: 10 Feet Spray: 70 Feet	10 Feet	None
Allowable Uses			
Agricultural Irrigation	Restricted	Restricted	Unrestricted
Parks, Playgrounds & Golf Courses with Residences	Not Allowed	Not Allowed	Signage, Additional Buffers
Parks, Playgrounds & Golf Courses w/no Residences	Signage, Additional Buffers	Signage, Additional Buffers	Signage
Cemeteries, Highway medians, landscape areas	Signage, Additional Buffers	Signage, Additional Buffers	Signage
Industrial/Commercial	Restricted	Restricted	Restricted
Construction	Restricted	Restricted	Restricted
Impoundment (Restricted)	Not Allowed	Restricted	Restricted

2.5.1 Reclaimed Water Use Plan

OAR 340-055-020 requires the preparation of a Reclaimed Water Use Plan for review and approval prior to application of reclaimed water for any beneficial use. While DEQ has primary responsibility for regulating the production and use of reclaimed water in Oregon, the Oregon Department of Health Services Drinking Water Division (OHD) also reviews and provides comments on Reclaimed Water Use Plans, and must provide concurrence to assure proposed reclaimed water uses will not negatively impact the public health.

2.5.2 Oregon Groundwater Protection Requirements

OAR 340-55 includes groundwater protection requirements associated with reclaimed water application and states "No reclaimed water shall be authorized for use unless all requirements for groundwater protection established in OAR 340-40 are satisfied. OAR 340-40 requirements are considered satisfied by DEQ if the sewage treatment system owner demonstrates that reclaimed water will not be used in a manner or applied at rates that cause contaminants to be leached into groundwater in quantities that will adversely affect groundwater quality."

2.5.3 Registration with Oregon Water Resources Department

Oregon Senate Bill 204, codified in ORS 537.131, 537.132 and 540.610(h), directs any reclaimed water user to file a registration form with the Oregon Water Resources Department (WRD). The reclaimed water user does not forfeit any water rights by either using reclaimed water or filing the registration form. However, all or a portion of an existing water right may be forfeited if unused for a period of five years.

Registration of the reclaimed water use allows the reclaimed water user to continue using the full amount of water allotted through an existing water right agreement in addition to the reclaimed water. A reclaimed water user can also decide to sell an existing water right or convert the water right to in-stream uses. The reclaimed water user is responsible for filing the registration form with WRD, but is typically assisted by the reclaimed water purveyor.

If implementation of a reuse program reduces existing stream flows by 50% or more, the WRD will evaluate the reduction in stream flow and its affect on existing water right holders. If a water right holder demonstrates that they are impaired by the reduction in stream flow, they shall be given preferential use of the reclaimed water. WRD will examine existing stream flows for only the timeframe in which the reuse program is implemented. If the intent of the water reuse program is to be seasonal, then WRD will examine and compare stream flows for that season.

Based on the dry weather design flow of 0.34 MGD and a 7Q10 low flow in Mill Creek of 2.39 cfs, it appears irrigation of Hubbard WWTP effluent in the critical summer months could potentially reduce Mill Creek flows by 14%. This reduction in Mill Creek flow does not appear to fall within the 50% reduction that would invoke the City to offer the effluent to downstream water right holders.

Table 5 below includes a summary of Mill Creek withdrawals between the Hubbard WWTP outfall and the downstream confluence of Mill Creek with Seneca Creek. The majority of surface water withdrawals downstream of the Hubbard WWTP outfall are senior water rights with priority dates between 1934 and 1967. All withdrawals are for irrigation purposes only.

Table 5: Mill Creek Surface Water Rights Downstream of Hubbard WWTP

Owner	Certificate #	Use	Priority Year	Max Rate (cfs)
Doubrava	22431	Irrigation	1952	0.13
Waddington	36325	Irrigation	1964	0.10
Doubrava	20069	Irrigation	1947	0.19
Woodburn-Hubbard Irrigation District	49285	Irrigation	1934	0.98
Brundage	24304	Irrigation	1949	0.53
Bisanz	35502	Irrigation	1964	0.54
Ernst	66053	Irrigation	1983	0.33

Owner	Certificate #	Use	Priority Year	Max Rate (cfs)
Harms	24110	Irrigation	1949	0.26
Sather	22353	Irrigation	1951	0.11
Koenig	22714	Irrigation	1953	0.31
Koenig	22472	Irrigation	1949	0.095
Koenig	38368	Irrigation	1967	0.39

2.5.4 Hubbard WWTP Reclaimed Water Production

Based on recent Discharge Monitoring Reports (DMRs), the Hubbard WWTP effluent consistently meets standards for Oregon Level II Reclaimed Water. Upgrade of the existing UV disinfection facilities at the Hubbard WWTP will most likely be required to consistently produce effluent meeting Oregon Level III reclaimed water standards.

There are several local reclaimed water demands available locally for treated Hubbard WWTP effluent. The biggest issue with full implementation of a water reuse program may be the potential reduction in Mill Creek flows. If the stream flow is reduced by 50% or more, an evaluation to identify impaired uses may be required by the WRD. The City should evaluate the potential for downstream impacts during preparation of a Reclaimed Water Use Plan.

2.6 Summary of Regulatory Issues

Following is a summary of the regulatory issues noted in the above sections:

- The WWTP discharge is likely to consistently meet all NPDES Permit limits except the Excess Thermal Load. The City should request the thermal load be increased or a compliance schedule be included in the NPDES permit.
- The NPDES Permit will likely be re-opened after completion of the Molalla-Pudding Subbasin TMDL to modify the Excess Thermal Load limit included in the permit.
- Based on the Dilution Rule, the Hubbard WWTP direct discharge to Mill Creek will be limited from June through September as summarized in the Dilution Rule Evaluation included in Appendix D.
- Based on the Oregon Temperature Standard, the Hubbard WWTP direct discharge to Mill Creek will be limited from July through October as summarized in the Temperature Standard Evaluation included in Appendix E.
- It does not appear that the City will need to comply with Oregon Senate Bill 204 because the reduction in stream flows resulting from the City's water reuse program will not be greater than 50%. However, the City may consider downstream surface water right holders as potential opportunities for developed local reclaimed water demand.
- Currently, it appears the Hubbard WWTP consistently produces effluent meeting Oregon Level II Reclaimed Water standards. Upgrade of the existing UV disinfection facilities would likely be required to produce Oregon Level III Reclaimed Water.

Section 3: Methodology

This section summarizes how selected alternatives will be evaluated to determine the best option for the City.

3.1 Evaluation Procedure

Alternatives are evaluated using a matrix-based approach incorporating economic and non-economic evaluation criteria. Scores to select the best alternative for the City were calculated by ranking each alternative relative to others and assigning a relative importance, or Weighting, to each criterion. The alternative with the highest Score represents the best alternative for the City.

$$Score = \sum_{Criteria} (Rank * Weighting)$$

3.1.1 Rank

Alternatives are ranked from best to worst based on the number of alternatives being evaluated. An evaluation of three alternatives will have rankings for each criterion from 4 (best) to 1 (worst). Alternatives tied for a specific rank are each assigned the higher rank and the next best alternative is assigned a rank two positions lower. For example, two alternatives tied for the best option are assigned a rank of "4" and the third alternative is assigned a rank of "2."

3.1.2 Weighting

The Weighting factor is a percentage-based multiplier allowing the City to place greater emphasis on specific criteria of greater importance for the city. For example, life cycle and capital costs are important to the City and are given a higher Weighting in the overall evaluation. The total of all Weightings developed with input from City staff is 100%. For example, life cycle and capital costs are very important to the City and were assigned Weightings of 40% and 20%, respectively, as recommended by City staff.

3.2 Evaluation Criteria

Evaluation Criteria used in the alternative evaluation include:

- Life Cycle Cost (20 year period)
- Capital cost
- Regulatory Compliance
- Environmental, Permitting and Acquisition
- City Control of Facilities

3.2.1 Life Cycle Cost (40%)

The overall life-cycle cost of an alternative, including capital costs for construction of facilities, permitting, easement and land acquisition, 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 like groundwater monitoring that may be required. Chemical costs are typically included in O&M costs, but none of the proposed alternatives will include additional chemicals. O&M Costs are based on a Net Present Worth (NPW) of capital improvement cost and annual O&M costs. NPW alternative costs are based on:

- Labor Rate: $45/hour
- Energy Rate: $0.06/kilowatt-hour (kWh)
- Discount Rate: 4%
- Evaluation Period: 20 years
- Residual Value: $0

3.2.2 Capital Cost (20%)

Capital costs are those costs associated with constructing facilities and appurtenances required for each alternative. Capital improvements may include treatment plant upgrades, pumping facilities, pipelines and discharge or holding facilities. Recommended facilities were sized for 2025 design flows.

Capital costs estimates for each alternative are included in Appendix G. Costs are based on recent project cost estimates, RS Means construction cost data and the Engineer's experience on similar projects. Mark-ups included in construction costs estimates include a reserve for Engineering, Surveying, Legal and Administration of 25% to 35% and Contingency of 20% to 40% of estimated construction cost, depending on the complexity and risk.

3.2.3 Regulatory Compliance (20%)

Regulatory compliance is based on the reliability of each alternative for meeting current and future NPDES requirements for the Hubbard WWTP. Each selected alternative should result in the City meeting all anticipated NPDES requirements, but certain alternatives may have more variability or higher risk in terms of long term compliance. Those alternatives not meeting future regulatory requirements are given the lowest ranking.

3.2.4 Environmental, Permitting & Acquisition (10%)

Environmental and permitting is related to the relative complexity and cost of obtaining approval for an alternative. Environmental and permitting may involve anti-degradation evaluations for discharges to surface water bodies, wetlands permitting and mitigation, reclaimed water use planning and permitting, hydro-geological evaluations, groundwater permits and monitoring, right-of-way permits and easements and planning applications and permits.

Right-of-way permits, easement acquisition and land purchases for proposed alternatives are included in the Environmental, Permitting and Acquisition criterion.

3.2.5 City Control of Facilities (10%)

City Control of Facilities relates to the level of authority of City staff in operating and maintaining the facilities. For example, reclaimed water uses will likely require the City to rely on a farmer to irrigate WWTP effluent on a regular basis to ensure adequate capacity is available. This is a lower level of control than if the City were to construct a new outfall to the Pudding River.

Section 4: Alternatives

Four alternatives have been identified that provide the highest probability of reliable compliance of the Hubbard WWTP discharge for current and future regulations. Alternatives evaluated to address the regulatory issues summarized in Section 2 include:

1. Pudding River Outfall with Staged Mill Creek Discharge
2. Subsurface Discharge with Staged Mill Creek Discharge
3. Reclaimed Water Irrigation with Staged Mill Creek Discharge
4. Mechanical Cooling of WWTP Effluent.

4.1 Staged Mill Creek Discharge

As shown in the Dilution Rule and Temperature Standard Analyses included in Appendix D and E, the allowable discharge to Mill Creek in the summer season is less than the projected 2025 WWTP effluent discharge. However, Mill Creek has some flow and assimilative capacity throughout the summer season which should be utilized by the City for direct discharge. A stage-based discharge, which is discharging a portion of the WWTP effluent based on the amount of flow in Mill Creek, will reduce the required alternate discharge capacity and operating costs and has, therefore, been included as part of all three alternatives to be evaluated.

Table 6 summarizes the allowable discharge from the Hubbard WWTP to Mill Creek from May through October. The Allowable Staged River Discharge in Table 6 is the lowest of the calculated allowable discharge for the Dilution Rule and Temperature Standard evaluations. The Required Alternate Discharge Capacity in Table 6 is the projected 2025 Hubbard WWTP Monthly Average Flow as summarized in the Dilution Rule Analysis included in Appendix D.

Important Note: Hubbard WWTP effluent is generally of higher quality than Mill Creek and represents a large portion of the flow in the Creek. Leaving the flow in Mill Creek is beneficial to the endangered salmonid species that the regulations requiring the City to remove effluent from the Creek are trying to protect.

Table 6: Staged Discharge to Mill Creek
City of Hubbard WWTP

Month	Dilution Rule Allowable Discharge (MGD)	Temperature Standard Allowable Discharge (MGD)	Allowable Staged River Discharge (MGD)	2025 WWTP Monthly Average Flow (MGD)	Required Alternate Discharge Capacity (MGD)
May	0.44	0.26	0.26	0.26	0.00
June	0.22	0.10	0.10	0.22	0.12
July	0.22	0.06	0.06	0.21	0.15
August	0.22	0.03	0.03	0.22	0.19
September	0.22	0.08	0.08	0.20	0.12
October	0.44	0.19	0.19	0.19	0.00

As shown in Table 6, an alternate Hubbard WWTP discharge is required from June through September. The months with lowest assimilative capacity, and highest required alternate discharge capacity, are July, August and September. It is anticipated that the first two weeks in June will also have assimilative capacity, but additional data collection is required to verify.

4.1.1 Alternate Discharge Design Capacity

Based on Table 6, the required alternate discharge capacity of future treatment and reuse facilities for the Hubbard WWTP is 0.19 MGD.

While treatment processes in sewage treatment facilities are design for MMDWF, pumping facilities and discharge pipelines must be designed for peak flows. Flow projections in the 2004 PreDesign Report indicate the 2025 PIF is 0.57 MGD, corresponding to a PIF/MMDWF peaking factor of 2.60. Therefore, the recommended design pumping and distribution system capacity for alternate discharge facilities is 0.49 MGD.

4.2 Pudding River Outfall with Staged Mill Creek Discharge

The most reliable alternative is to construct a second outfall to a stream with greater assimilative capacity in the summer months when discharge to Mill Creek will be limited in the future. The Pudding River is the nearest candidate stream. No evaluation of Pudding River water quality was completed as part of this study, but the Pudding River most likely has high enough flows in the summer season to assimilate the relatively small Hubbard WWTP summer season discharge. It should be noted that temperature issues may also limit discharge to the Pudding River when the Molalla-Pudding TMDL is completed.

Exhibit 3 shows the conceptual layout for a new Pudding River outfall. The estimated 20-year Life Cycle Cost for a new Pudding River outfall, including capital improvements, annual operations and maintenance and permitting is approximately $3,010,000.

4.2.1 Capital Improvements

The estimated capital improvements cost for construction of a new Pudding River outfall is $2,460,000 with a range of accuracy of -20% to +30%.

- **Treatment Plant Improvements.** No additional treatment plant upgrades are anticipated to improve effluent water quality associated with construction of a new outfall to the Pudding River.

- **Treated Effluent Pump Station.** A duplex submersible pump station with 20 horsepower pumps would be constructed in the unused chlorine contact chamber downstream of the disinfection facilities. The pumps would be design to discharge 0.49 MGD at approximately 140-feet Total Dynamic Head (TDH). Flow would be split between the direct discharge outfall and the pump station by a gated bypass channel.

- **Discharge Force Main.** A new 6" force main would be constructed from the Hubbard WWTP to the Pudding River approximately 17, 500 feet along the alignment shown in Exhibit 3.

- **Pudding River Outfall.** A new outfall diffuser would be constructed in the Pudding River. The planned outfall would be a single port, center channel diffuser installed via trenchless methods using horizontal directional drilling.

4.2.2 Operations & Maintenance

Annual operations and maintenance (O&M) costs associated with a new Pudding River outfall include pump and pipeline maintenance, energy costs for pumping and City staff time of approximately four hours per week during operation. The estimated annual O&M cost is $31,800 with a 20-year net present worth of $430,000.

4.2.3 Regulatory Compliance

Assuming the Pudding River has assimilative capacity for Hubbard WWTP flows, the Mill Creek and Pudding River outfalls would reliably meet NPDES Permit requirements with minimal additional monitoring and reporting requirements aside from WWTP discharge monitoring reports (DMRs).

4.2.4 Environmental, Permitting & Acquisition

Construction of a new Pudding River outfall diffuser will have significant environmental and permitting requirements. An anti-degradation evaluation with formal public comment will be required by the DEQ and the Environmental Quality Commission (EQC). A full environmental review meeting requirements of the National Environmental Policy Act (NEPA) may also be required. Other environmental and permitting requirements will include county right-of-way permits and acquisition easements on private property. The estimated cost for environmental, permitting and acquisition for new Pudding River outfall is $120,000.

4.2.5 City Control of Facilities

The City would maintain full operational control of a new Pudding River outfall and would not rely on another public agency or private entity to meet NPDES Permit requirements.

4.3 Subsurface Discharge with Staged Mill Creek Discharge

The City owns several parcels adjacent to the Mill Creek which could be used to construct two rapid infiltration (RI) basins that would percolate treated effluent into the ground and hyporheic zone of Mill Creek. Exhibit 4 shows a map of six City-owned parcels adjacent to the treatment plant and the site soils with permeability rates in the vicinity of Mill Creek. The six City-owned parcels totaling 2.1 acres could be used for a new subsurface discharge outfall.

The permeability rates for site soils shown in Exhibit 4 indicate the capacity of site soils to percolate treated effluent into the ground through a new subsurface discharge outfall. The area soils are Willamette Valley silts which generally have low percolation rates and are not the best

option for subsurface injection. The subsurface discharge facility would require two 1.50-acre RI basins to provide adequate dose-rest cycles, based on a design percolation rate of 0.20 inches per hour and a design flow rate of 0.19 MGD. The required area of 3.0 acres is greater than the area owned by the City in the vicinity. Therefore, construction of a new subsurface discharge outfall will require the City to purchase another one-acre parcel adjacent to the existing City-owned parcels.

Groundwater monitoring wells would be required upstream and downstream of subsurface discharge facilities to monitor groundwater quality. Additional treatment plant improvements may be required to meet a limit of 10 mg/l Total Nitrogen for compliance with OAR Division 44 protecting groundwater quality. However, Kennedy/Jenks experience on recent subsurface discharge projects indicates the Total Nitrogen limit can likely be met through in-situ soil treatment. Therefore, no additional treatment plant improvements are anticipated for nutrient removal.

The DEQ is currently completing an Internal Management Directive (IMD) relating to subsurface discharge of treated effluent. While the Subsurface Discharge IMD is not yet available, the DEQ has indicated that effluent discharged through subsurface facilities like RI Basins will need to consistently meet Oregon Level III reclaimed water quality. It is assumed this will require the installation of additional UV disinfection capacity at the treatment plant to consistently meet the Level III Total Coliform limit of 2.2 organisms/100 mL.

The 20-year Life Cycle Cost for a new subsurface discharge outfall, including capital improvements, annual operations and maintenance, permitting and land acquisition is $2,400,000. It should be noted that higher contingency percentages are used in this estimate to cover the increased risk associated with subsurface discharge.

4.3.1 Capital Improvements

The estimated capital improvements cost for a new subsurface discharge outfall is $1,570,000 with a range of accuracy of -20% to +30%.

- **Treatment Plant Improvements.** Upgrade of UV disinfection facilities to consistently meet Oregon Level III reclaimed water quality requirements.
- **Treated Effluent Pump Station.** A duplex submersible pump station with five horsepower pumps would be constructed in the unused chlorine contact chamber downstream of the disinfection facilities. The pumps would be designed to discharge 0.49 MGD at approximately 35-feet Total Dynamic Head (TDH). Flow would be split between the subsurface discharge outfall and the pump station by a gated bypass channel. A gated, discharge control structure would be constructed to control flows to the two RI basins.
- **Discharge Force Main.** A new 6-inch force main would be constructed from the Hubbard WWTP approximately 1,000 feet to the City-owned parcels.
- **Rapid Infiltration Basins and Monitoring Wells.** Two 1.5-acre rapid infiltration basins would be constructed on the City-owned parcels.

4.3.2 Operations & Maintenance

Ongoing operations and maintenance (O&M) costs associated with a subsurface discharge outfall include additional energy costs to pump treated effluent to the RI Basins and approximately 12 hours per week of staff time to operate and maintain the new facilities. The estimated annual O&M cost for the improvements is $44,100. The net present worth of 20 years O&M costs is $600,000.

4.3.3 Regulatory Compliance

Subsurface discharge facilities would provide a reliable and cost effective alternate discharge during the summer season when direct discharge to Mill Creek is limited. The subsurface discharge facilities would polish effluent by providing in-situ soil-based treatment of BOD and temperature. During certain periods in the summer season, high nitrogen loading rates may exceed the in-situ treatment capacity. This is an unknown that can only be evaluated on a case-by-case basis.

4.3.4 Environmental, Permitting and Acquisition

Subsurface discharge is an emerging alternative for effluent disposal and Kennedy/Jenks has been involved in many similar projects in the past few years. Permits will be required from DEQ to construct the facilities, which will involve field testing and monitoring groundwater quality over time. The biggest issue with subsurface discharge facilities has been in conflict with Oregon's Underground Injection Control (UIC) rules, but these rules are not applicable if the discharge is to a RI basin that is not regulated as a UIC.

The City will also need to acquire additional land for the subsurface discharge outfall because the 2.1 acres owned by the City is less than the 3.0 acres required for a new subsurface discharge outfall. The estimated cost for acquisition of an additional one-acre parcel is $75,000. The estimated cost for environmental, permitting and acquisition is approximately $230,000.

4.3.5 City Control of Facilities

The City would maintain full operational control of a new subsurface discharge outfall and would not rely on another public agency or private entity to meet NPDES Permit requirements.

4.4 Reclaimed Water Irrigation with Staged Mill Creek Discharge

Reclaimed water production and distribution as allowed in OAR 340-55 is the third alternative evaluation for an alternate to direct Mill Creek discharge. There are many candidate farms in close proximity to the Hubbard WWTP who may be willing to have a reclaimed water holding pond constructed on their property for use in irrigating non-consumable crops. Two local grass sod production companies are prime candidates: JB Instant Lawn and Oregon Turf and Tree Farms. Oregon Turf and Tree Farms currently accepts Class B Biosolids from the WWTP.

While land acquisition costs are not included in the detailed evaluation, the City may prefer to purchase a parcel for land irrigation rather than contract with either of the sod production

companies. Depending on the negotiated period for staged discharge with DEQ, the City would need to acquire a 40 to 60 acre parcel with requisite site soil properties for irrigation of Level II Reclaimed Water from the Hubbard WWTP. It is anticipated the negotiated irrigation period would be from mid-June through the end of September.

If the City elects to purchase a tract for agronomic irrigation, rather than partner with a local sod farmer, the actual parcel size required should be evaluated based on an actual site under consideration and the actual period of irrigation. Potential parcels and related costs for purchase by the City in the vicinity of the WWTP were not evaluated as part of this study.

4.4.1 Options for Reclaimed Water Irrigation

Preliminary reclaimed water irrigation options evaluated as part of this study include:

1. Landscape irrigation on City-owned parks shown in Exhibit 5.
2. Agricultural irrigation on a nearby sod farmer's property as shown in Exhibit 6.

Irrigation on City parks would provide better City control over the ultimate distribution and irrigation, but would also require Oregon Level IV Reclaimed Water to address regulatory requirements and public safety concerns relating to public contact. Production of Level IV Reclaimed Water would require the installation of additional facilities for coagulation, flocculation and filtration of WWTP effluent. Costs for these improvements would be prohibitive if there is a better reclaimed water irrigation option.

Agricultural irrigation on grass sod does not have the same issues with public safety and can be done with Level II Reclaimed Water. The Hubbard WWTP consistently produces effluent meeting Level II Reclaimed Water requirements. Therefore, agricultural irrigation on a nearby grass sod farm was selected as the best reclaimed water irrigation option.

The 20-year Life Cycle Cost for agricultural irrigation of reclaimed water, including capital improvements, annual operations and maintenance and permitting is $1,930,000.

4.4.2 Capital Improvements

The estimated capital improvements cost for a new subsurface discharge outfall is $1,640,000 with a range of accuracy of -20% to +30%.

- **Treatment Plant Improvements.** No additional treatment plant upgrades are anticipated to improve effluent water quality associated with construction of a new outfall to the Pudding River. However, additional monitoring may be required as part of an approved Reclaimed Water Use Plan.

- **Treated Effluent Pump Station.** A duplex submersible pump station with 10 horsepower pumps would be constructed in the unused chlorine contact chamber downstream of the disinfection facilities. The pumps would be designed to discharge 0.49 MGD at approximately 60-feet Total Dynamic Head (TDH).

- **Discharge Force Main.** A new 6" force main would be constructed from the Hubbard WWTP approximately 5,500 feet to the reclaimed water irrigation site.

- **Reclaimed Water Holding Pond.** A reclaimed water holding pond would be constructed on the sod farmer's property. The pond would be constructed in an existing swale. An embankment will be constructed at the downstream end of the swale and an HDPE liner will be installed.

- **Additional Facilities not included in Capital Costs.** Additional facilities anticipated to be provided by the sod farmer, and not included in the cost estimate includes an irrigation pump and distribution pipelines.

4.4.3 Operations & Maintenance

Ongoing operations and maintenance (O&M) costs associated with reclaimed water irrigation include additional energy costs to pump treated effluent to the reclaimed water holding pond and approximately six hours per week of staff time to operate and maintain the new facilities and coordinate with the sod farmer. The estimated annual O&M cost for the improvements is $17,000. The net present worth of 20 years O&M costs is $230,000.

4.4.4 Regulatory Compliance

The production and use of Oregon Level II Reclaimed Water for agricultural irrigation on sod is allowed in OAR 340-55, with certain requirements and limitations. This alternative will require additional monitoring and reporting requirements according to an approved Reclaimed Water Use Plan.

4.4.5 Environmental, Permitting and Acquisition

The City will be required to prepare a Reclaimed Water Use Plan for review by the DEQ, Oregon Health Division and other regulatory agencies. In addition, the City will be required to complete an evaluation of impacts on Mill Creek flows and may be required to meet additional constraints to meet requirements Oregon WRD requirements if the flow in Mill Creek is reduced by more than 50%. The estimated cost for environmental and permitting, including right-of-way permits and negotiations with the grass sod farmer is $60,000.

The City may be required to obtain easements for the reclaimed water pipeline and the project will require a Reclaimed Water Use Agreement with the participating property owner that will irrigate, accept, and utilize the reclaimed water.

4.4.6 City Control of Facilities

The City would not maintain full operational control of the reclaimed water facilities. Coordination would be required between City staff and the sod farmer for reclaimed water demand and irrigation requirements to ensure reclaimed water quality in the holding pond and irrigation in a timely manner. The City would remain responsible for ensuring that the reclaimed water is not irrigated at rates greater than agronomic uptake by the grass sod farm to ensure the protection of groundwater quality.

4.5.3 Operations & Maintenance

Annual operations and maintenance (O&M) costs associated with the mechanical cooling equipment would include chiller, pump and pipeline maintenance, energy costs for the chillers and ancillary equipment and City staff time of approximately six hours per week during operation. The estimated annual O&M cost is $74,400 with a 20-year net present worth of $1,010,000.

4.5.4 Environmental, Permitting & Acquisition

Construction of mechanical cooling equipment at the WWTP will involve preparation of DEQ reports and general permitting which is estimated to cost $25,000.

4.5.5 City Control of Facilities

The City would maintain full operational control of mechanical cooling equipment and would not rely on another public agency or private entity to meet NPDES Permit requirements.

4.5 Mechanical Cooling of WWTP Effluent

An available option for meeting the excess thermal load limit in the City's NPDES permit is to install mechanical cooling (chillers) downstream of the disinfection channel as shown on Exhibit 7. Chillers would be relatively easy to install and have a low capital cost when compared to other options. The biggest advantages of mechanical cooling are a relatively low capital cost compared with other alternatives and they can be constructed quickly on the lower WWTP site. Several drawbacks of mechanical cooling include:

- Power Demand. Chillers have a large power demand and high energy consumption which makes them very expensive to operate over a 20 year life.
- The heated cooling waste is returned to the WWTP headworks, thus returning the heat extracted by the process back into the treatment plant whereby it then needs to be removed again by the mechanical cooling equipment.
- Installing chillers may address the excess thermal load issues, but would not address the issues with BOD_5 and the Dilution Rule.

The estimated 20-year Life Cycle Cost for installing two new chillers with full redundancy, including capital improvements, annual operations, and maintenance and permitting is approximately $2,130,000.

4.5.1 Capital Improvements

The estimated capital improvements cost for installing mechanical cooling at the treatment plant is $1,054090,000 with a range of accuracy of -20% to +30%.

- **Treatment Plant Improvements.** The chillers would be installed on the lower WWTP site downstream of the chlorine contact chamber. The chillers would be skid-mounted with integral pumping equipment and could possibly require upgrades to both the WWTP electrical service and the new standby generator.

- **Chiller Influent Control Structure.** A gated control structure would be constructed in the effluent discharge basin that would divert flows to the existing 8" C900 PVC force main.

- **Chiller Effluent Piping.** Cooled effluent from the chillers would be discharged through the 8" C900 PVC force main, which would either be extended to Mill Creek of connected to the existing WWTP outfall pipeline.

- **Chiller Waste Return.** Heated waste from the chillers would be pumped from the lower WWTP site to the WWTP influent channel upstream of the new Selector Basin as shown in Exhibit 7.

4.5.2 Regulatory Compliance

Mechanical cooling of WWTP effluent would address the issue of excess thermal load from the treatment plant, but would not address the other regulatory issue relating to BOD5 and the Dilution Rule.

Section 5: Recommended Alternative

Following is a matrix-based evaluation of the three alternate discharge options evaluated for the City of Hubbard to meet anticipated future regulatory requirements. Weightings for evaluation criteria are included and sum to 100%. Scores for each criterion are assigned from 4 (best) to 1 (worst) with the highest possible score 4.00.

Table 7: Discharge Alternatives Evaluation
City of Hubbard WWTP

Evaluation Criteria	Weighting	Pudding River Outfall with Staged Mill Creek Discharge	Subsurface Discharge with Staged Mill Creek Discharge	Reclaimed Water Irrigation with Staged Mill Creek Discharge	Mechanical Cooling of WWTP Effluent
Life Cycle Cost	40%	1	3	4	2
Capital Cost	20%	10	3	3	4
Regulatory Compliance	20%	4	2	3	1
Environmental & Permitting	10%	1	2	3	4
City Control of Facilities	10%	2	3	1	4
Total Score	100%	1.70	2.70	3.20	2.60

Based on the alternative evaluation, the apparent best option available to the City of Hubbard for meeting anticipated future regulatory requirements at the Hubbard WWTP is Reclaimed Water Agricultural Irrigation with Staged Mill Creek Discharge.

City staff had a preliminary meeting with representatives from Oregon Turf and Tree Farms about partnering on a reclaimed water program to irrigate grass sod grown by the company with Level II reclaimed water produced at the Hubbard WWTP. Representatives from Oregon Turf and Tree Farms has expressed interest and are willing to enter into a Reclaimed Water Use Agreement with the City, subject to review of the terms and conditions.

As an alternative to negotiating with Oregon Turf and Tree Farms, the City may desire to consider purchasing a parcel for irrigation to maintain control over all WWTP discharge facilities. Of concern, is the fact that Division 55 does not allow the responsibility for storage and distribution of reclaimed water from the Hubbard WWTP to be transferred to Oregon Turf and Tree Farms.

Section 6: Potential Funding Alternatives

The estimated capital construction cost for the recommended alternative, Reclaimed Water Irrigation with Staged Mill Creek Discharge, is $1,640,000. Programs for which the City may be eligible for obtaining low interest loans and grants include:

1. Oregon Department of Environmental Quality (DEQ)
2. Oregon Economic and Community Development Department (OECDD)
3. United States Department of Agriculture Rural Utilities Service (USDA-RUS)

6.1 Oregon Department of Environmental Quality

The Oregon DEQ administers the Clean Water State Revolving Fund (CWSRF) that provides low interest loans to Oregon municipalities for the planning, design and construction of sewage facilities, nonpoint source control, and estuary management projects. The CWSRF program, as administered based on OAR Chapter 340, Division 54 (OAR 340–54), provides funding for the following types of wastewater projects:

- Planning, design and construction of wastewater treatment facilities
- Biosolids disposal and management facilities
- Sanitary sewer interceptors, force mains and pumping stations
- Infiltration and Inflow (I/I) identification and correction
- Sanitary Sewer rehabilitation and replacement
- Combined Sewer Overflow separation
- Wastewater Reuse Projects
- Other estuarine and storm water related projects.

The CWSRF Program receives funding applications year-round from Oregon municipalities. After acceptance by DEQ, applications are reviewed for eligibility, ranked for overall water quality benefit and funded in the order of rankings based on available funds for the program year. If the program is deficient of funds for all approved applications, it may be necessary to re-apply in subsequent years to remain on the SRF project list. CWSRF loan rates vary based on current market conditions and are dependent on the type of wastewater project that includes planning, interim financing, or design and construction.

The DEQ CWSRF program provided funding in the form of a low-interest loan for the 2005 Hubbard WWTP Improvements Project.

6.2 Oregon Economic and Community Development Department

The Oregon Economic and Community Development Department (OECDD) administers two funding programs that may be available to the City:

- Water/Wastewater Fund

- Community Development Block Grant Program (CDBG)

6.2.1 OECDD Water/Wastewater Fund

The Water/Wastewater Fund was created in 1993 with funding provided by the Oregon Lottery, with the purpose of financing the design and construction of public infrastructure needed to ensure compliance with the Federal Safe Drinking Water Act (SDWA) and the Federal Clean Water Act (CWA). In order to be eligible for OECDD Water/Wastewater Fund grants and loans, a project must meet the following criteria:

a. The project must be consistent with the acknowledged local comprehensive plan.

b. Recipient shall certify that a registered professional engineer will be responsible for the design and construction of the project.

The Water/Wastewater Fund provides both loans and grants, but it is primarily a loan program. The loan/grant amounts are determined by a financial analysis of the applicant's ability to repay a loan (debt capacity, repayment sources and other factors).

Grant awards are available for a maximum of $750,000 per project. An applicant is not eligible for grants if the applicant's annual median household income is greater than or equal to 100 percent of the state average median household income for the year of application.

6.2.2 OECDD Community Development Block Grant

Community Development Block Grant (CDBG) funding is subject to financial need, availability of funds and certain other restrictions that are included in the most current Method of Distribution. The Method of Distribution provides the guidelines that OECDD uses to determine the criteria for ranking funding applications. The amount of grant funds awarded to any project is dependent on the analysis of the application and financial information supplied by the applicant. The maximum amount of grant funds available for Public Works Water and Wastewater Improvements is $1,000,000. In order to obtain a CDBG Grant, the project must meet the following criteria:

a. It must be shown to benefit low- and moderate-income persons

b. The project must be shown to solve an immediate or serious threat to community health.

6.3 United States Department of Agriculture Rural Utilities Service

The USDA-RUS provides water and waste disposal loans and grants to rural municipalities for the construction, expansion or modification of water treatment and distribution systems and wastewater collection and treatment systems. Preference is given to projects in low-income communities with populations below 10,000. Grant and loan assistance is based on a tiered schedule, with the loan rate calculated using percent of Median Household Income (MHI). Lowest loan rates require a City's MHI to be less than 80% of the Oregon MHI. Eligibility for grants is also based on the user rate, which must fall within a "similar system cost" for communities served by the program that have completed improvements; currently about $40 per month.

The entire scope of the funding regulations can be found at:

- http://www.usda.gov/rus/water/regs/1_Guar1779a.doc
- http://www.usda.gov/rus/water/regs/1780.doc

Facilities financed must undergo an environmental impact analysis in accordance with the National Environmental Policy Act (NEPA) and other USDA-RUS requirements. The environmental review requirements can be performed simultaneously and concurrently with the planning and design of a project, providing flexibility to consider reasonable alternatives to the project and develop methods to mitigate adverse environmental effects. Facility design will incorporate and integrate, where practicable, mitigation measures that avoid or minimize adverse environmental impacts. If construction is started prior to completion of the environmental review and the Agency is deprived of its opportunity to fulfill its obligation to comply with applicable environmental requirements, the application for financial assistance may be denied. Satisfactory completion of the environmental review process must occur prior to the approval of the applicant's request or commitment of Agency resources.

Funding through the USDA-RUS can have a payback period of up to 40 years. It is generally acknowledged that compliance with the RUS requirements is more rigorous than other funding programs.

6.4 Summary of Funding Alternatives

The funding programs summarized previously are constantly evolving and other funding options may become available in the future as the City's recommended water reuse project moves past the concept stage. Kennedy/Jenks recommends that the City fully evaluate all funding options as the recommended water reuse project is approved by City Council and a detailed implementation schedule developed. It is most likely that the project will need to be financed with low-interest loans secured locally by user rates or general obligation bonds.

Section 7: Conclusions and Recommendations

Following are conclusions, recommendations and an implementation timeline associated with the City of Hubbard Alternate Discharge Alternatives Study.

7.1 Conclusions

Kennedy/Jenks concludes the following:

1. The Hubbard WWTP consistently meets current NPDES Permit Limits for Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS) and Bacteria (*E.coli*), but is unlikely to consistently meet the Excess Thermal Load included in the permit.

2. The City should request the Excess Thermal Load included in the NPDES Permit be modified based on WWTP and Mill Creek flows and loads summarized in the NPDES Permit Evaluation Report.

3. In the future, regulatory requirements will limit the Hubbard WWTP direct discharge to Mill Creek in the summer season. The primary issues are the Dilution Rule contained in the Oregon water quality standards narrative criteria, the Oregon Temperature Standard and the future Molalla-Pudding TMDL.

4. The 2005 Hubbard WWTP Improvements will maintain or improve effluent quality and could increase the allowable discharge to Mill Creek based on the Dilution Rule.

5. The Molalla-Pudding Temperature TMDL currently scheduled for completion in 2006 will likely contain wasteload allocations for the Hubbard WWTP based on the Oregon Temperature Standard.

6. Once completed, the Molalla-Pudding Temperature TMDL should be evaluated to verify the anticipated impact on limiting the Hubbard WWTP direct discharge to Mill Creek.

7. A stage-based discharge to Mill Creek should be included in all alternatives being considered by the City of Hubbard to reduce the size and cost of recommended facilities. The City should negotiate a stage-based discharge with direct discharge to Mill Creek in May, the first two weeks in June and October and limited direct discharge in the last two months of June, July, August and September. Additional flow and temperature data for the WWTP discharge and Mill Creek will provide for a more accurate determination of the stage-discharge relationship summarized in this report.

8. There is limited available flow and temperature data on Mill Creek in the vicinity of Hubbard. More data should be collected to verify flows and further evaluate the allowable stage-based summer season discharge.

9. Based on the costs and evaluation criteria presented in this report, the recommended alternative to meet future regulatory requirements at the Hubbard WWTP is Reclaimed Water Agricultural Irrigation with Staged Mill Creek Discharge.

10. The City may want to consider purchasing a parcel in the vicinity of the Hubbard WWTP for agricultural irrigation at agronomic rates rather than enter into agreement with a local

sod farmer. The approximate parcel size is between 60 and 120 acres depending on the allowable staged discharge negotiated with DEQ.

7.2 Recommendations

Based on the conclusions above, Kennedy/Jenks recommends the following steps be implemented by the City of Hubbard:

1. The City should request modification of the Excess Thermal Load included in the Hubbard WWTP NPDES Permit. A less desirable option would be to include a temperature compliance schedule in Schedule C of the NPDES Permit.

2. The City should provide a copy of the Discharge Study to the Oregon Department of Environmental Quality (DEQ) for review and comment. A follow-up meeting should be scheduled with DEQ to discuss the conclusions and recommendations and to better define the required timing anticipated regulatory requirements.

3. The City should collect Mill Creek hourly flow and temperature data in Mill Creek upstream and downstream of the WWTP outfall to verify assumptions used to develop the Excess Thermal Load in the NPDES Permit and assist in calculating allowable summer season staged-discharge to Mill Creek.

4. Based on the alternative evaluation, the recommended alternative is Reclaimed Water Irrigation with Staged Mill Creek Discharge. After completion and review of the Molalla-Pudding TMDL, the first step in moving forward with this alternative is the preparation of a Reclaimed Water Use Plan (RWUP) for summer season agricultural irrigation on nearby sod farms. The RWUP should include an evaluation of downstream impacts for the reduction of Mill Creek flows, which, if decreased by more than 50%, may require WRD investigation.

5. The City should proceed with negotiations and finalize an agreement with Oregon Turf and Tree Farms and enter into a Reclaimed Water Use Agreement.

6. The thermal wasteload allocation included in the future Molalla-Pudding TMDL may impact the City. Therefore, the City may want to consider moving forward with planning elements of the project like the reclaimed water use plan and negotiations with the sod farmer, but wait to implement the alternative until a full review of the Molalla-Pudding TMDL is completed after adoption by DEQ and the Environmental Protection Agency.

7. Evaluate funding alternatives and develop a funding plan that may involve a combination of local revenue sources and grants or loans from State and Federal agencies, including DEQ, OECDD and USDA-RUS.

8. After verification of Mill Creek flows and temperatures, adoption of the TMDL and approval of the project by the Hubbard City Council, the City should begin final planning, design and construction of recommended reclaimed water production, distribution and storage facilities.

7.3 Implementation Timeline

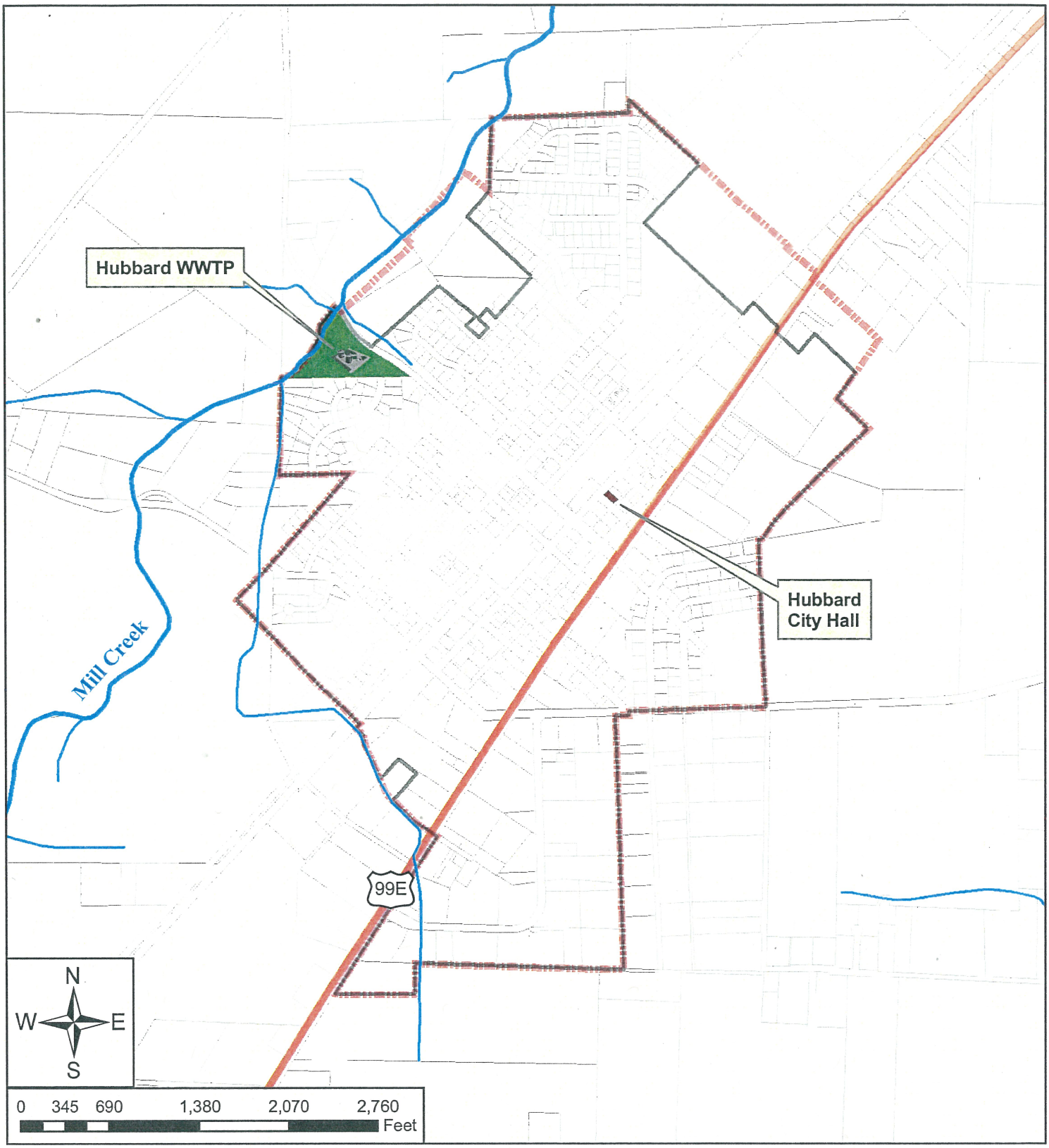
The current Hubbard WWTP NPDES includes provisions to re-open the Permit when the Molalla-Pudding TMDL is completed in 2006. Therefore, Kennedy/Jenks recommends the City begin planning for the alternate discharge by finalizing negotiations with the sod farmer and completing the Reclaimed Water Use Plan.

It is important to note that the conceptual timeline assumes the Molalla-Pudding TMDL is completed according to the current schedule published by DEQ and negotiations are finalized with Oregon Turf and Tree Farms or another site obtained by the City for reclaimed water irrigation. Kennedy/Jenks recommends the City proceed with the necessary planning and compliance requirements (collect Mill Creek flow and temperature data, prepare and submit reports, complete reclaimed water use agreements, etc.) in the City's NPDES Permit, but no improvements or reclaimed water and related facilities should be constructed until adoption of the Molalla-Pudding TMDL and subsequent impacts evaluation by the City.

Table 7 includes a Conceptual Project Timeline to assist the City in planning for implementation of the recommended reclaimed water facilities. The Timeline is based on the compliance schedule included in the City's current NPDES Permit and is summarized in Section 2.2.1 of this Report. The project timeline is subject to modification based on DEQ requirements and completion of the Molalla-Pudding TMDL.

Table 8: Conceptual Project Timeline

Task	Completion Period
Submit Alternate Discharge Study to DEQ	Spring 2006
Follow-up meeting with DEQ	Spring/Summer 2006
Collect Mill Creek Flow Data	Ongoing
Assumed Molalla-Pudding TMDL Approval Date	Winter 2006
Hubbard WWTP TMDL Evaluation Report Submittal	Spring/Summer 2007
Identify Candidate Sites & Users	2007
Prepare Reclaimed Water Use Plan	2007
Preliminary Design, Permitting & Funding	2008/09
Final Design, Bidding & Contracts	2009
Construction	2010



Legend

- City Limits
- Urban Growth Boundary (UBG)
- Property Lines
- WWTP Lot

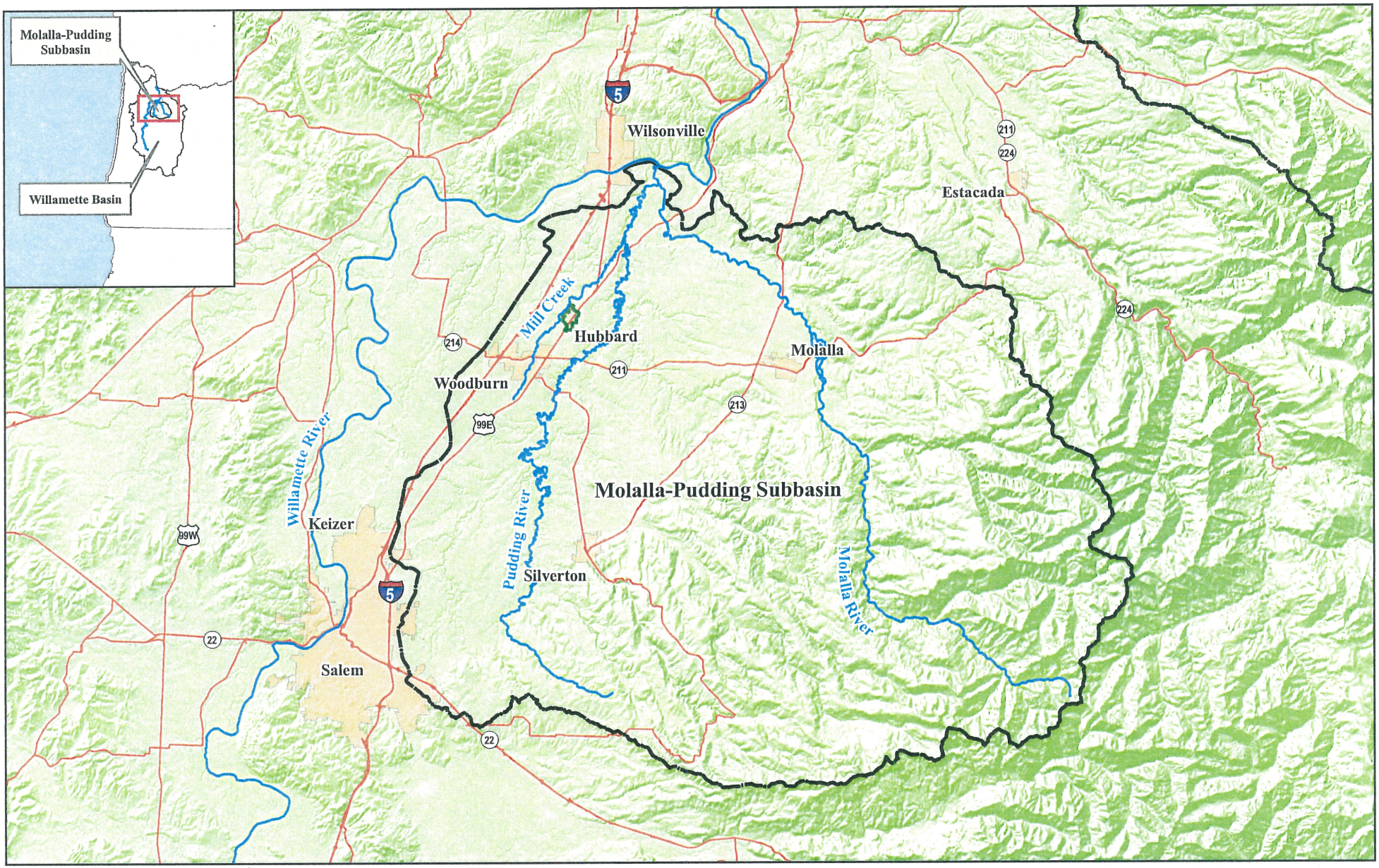
Kennedy/Jenks Consultants

Location Map
Hubbard Wastewater Treatment Plant

Alternate Discharge Alternatives Study
City of Hubbard, Oregon

0491011*00

Exhibit 1



N

0 2 4 8 12 16 Miles

Legend

- Rivers and Streams
- Roads
- Hubbard City Limits
- Urban Area
- Basin Boundary

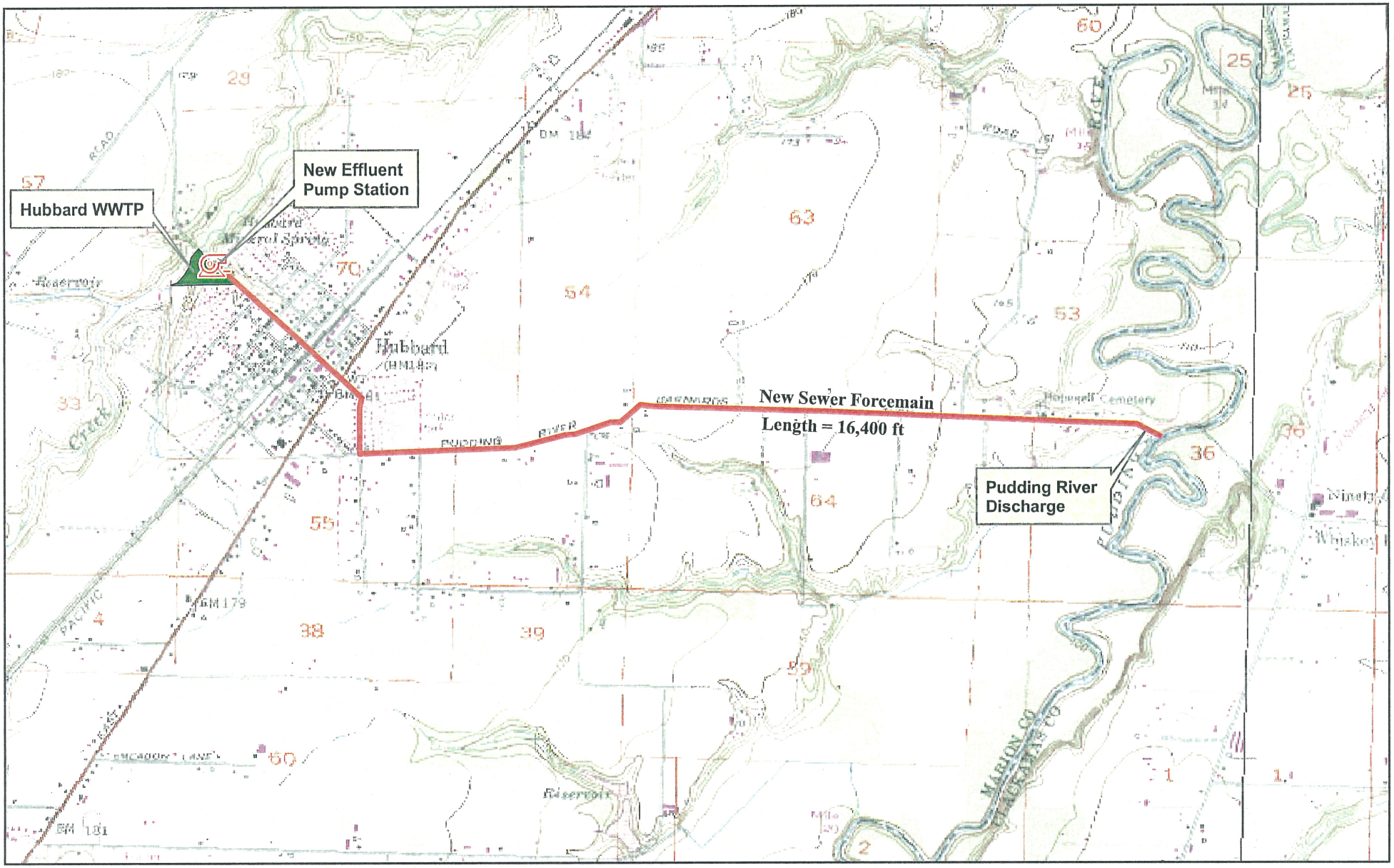
Kennedy/Jenks Consultants

Molalla/Pudding Basin
Willamette Basin Rivers

Alternate Discharge Alternatives Study
City of Hubbard, Oregon

0491011*00

Exhibit 2



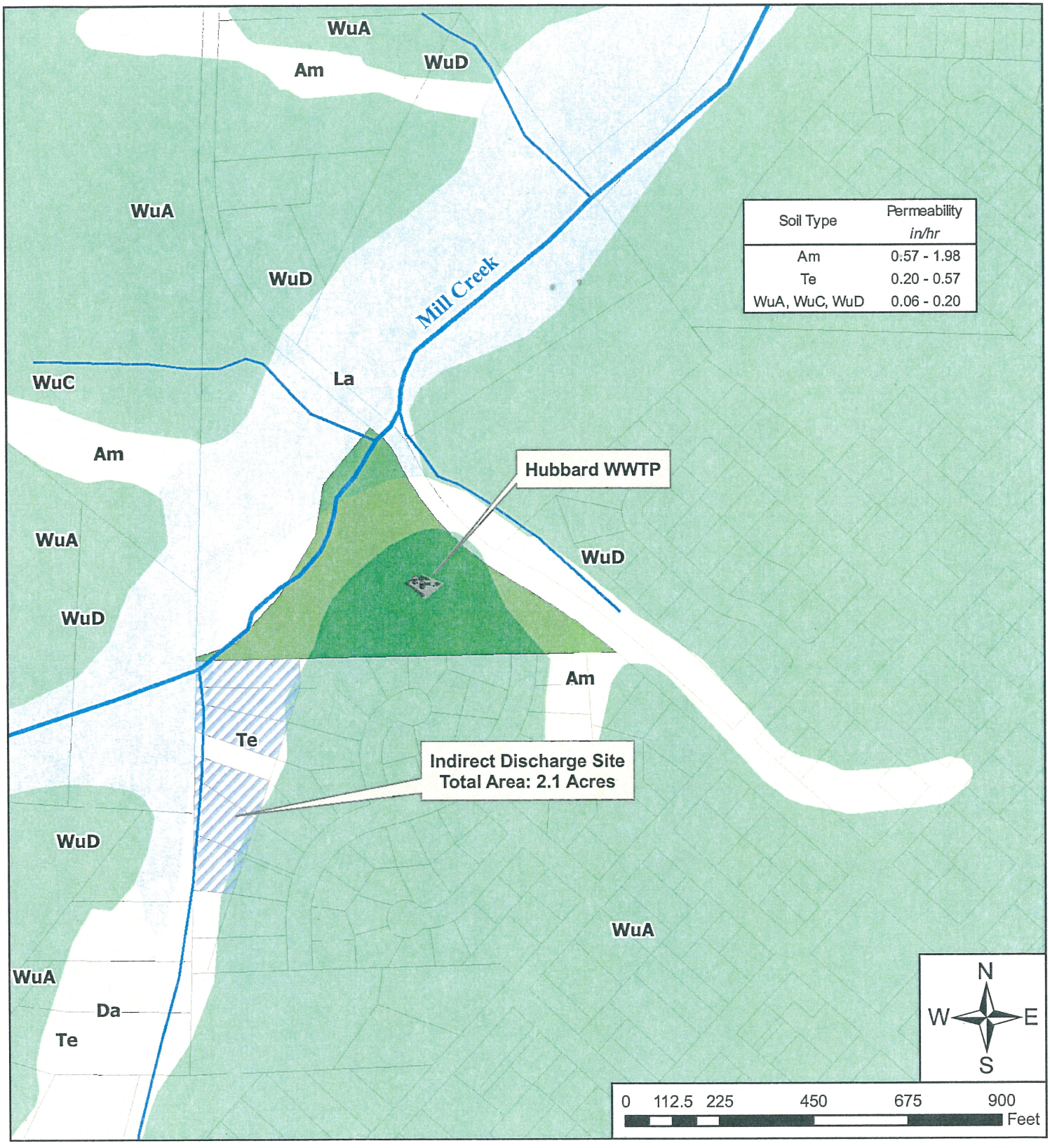
Kennedy/Jenks Consultants

New Pudding River Outfall
Conceptual Layout

Alternate Discharge Alternatives Study
City of Hubbard, Oregon

0491011*00

Exhibit 3



Legend

Soils
- Amity silt loam (AM)
- Dayton silt loam (Da)
- Labish silty clay loam (La)
- Terrace escarpments (Te)
- Woodburn silt loam (WuA, WuC, WuD)

WWTP Lot

City Owned Parcels

Streams

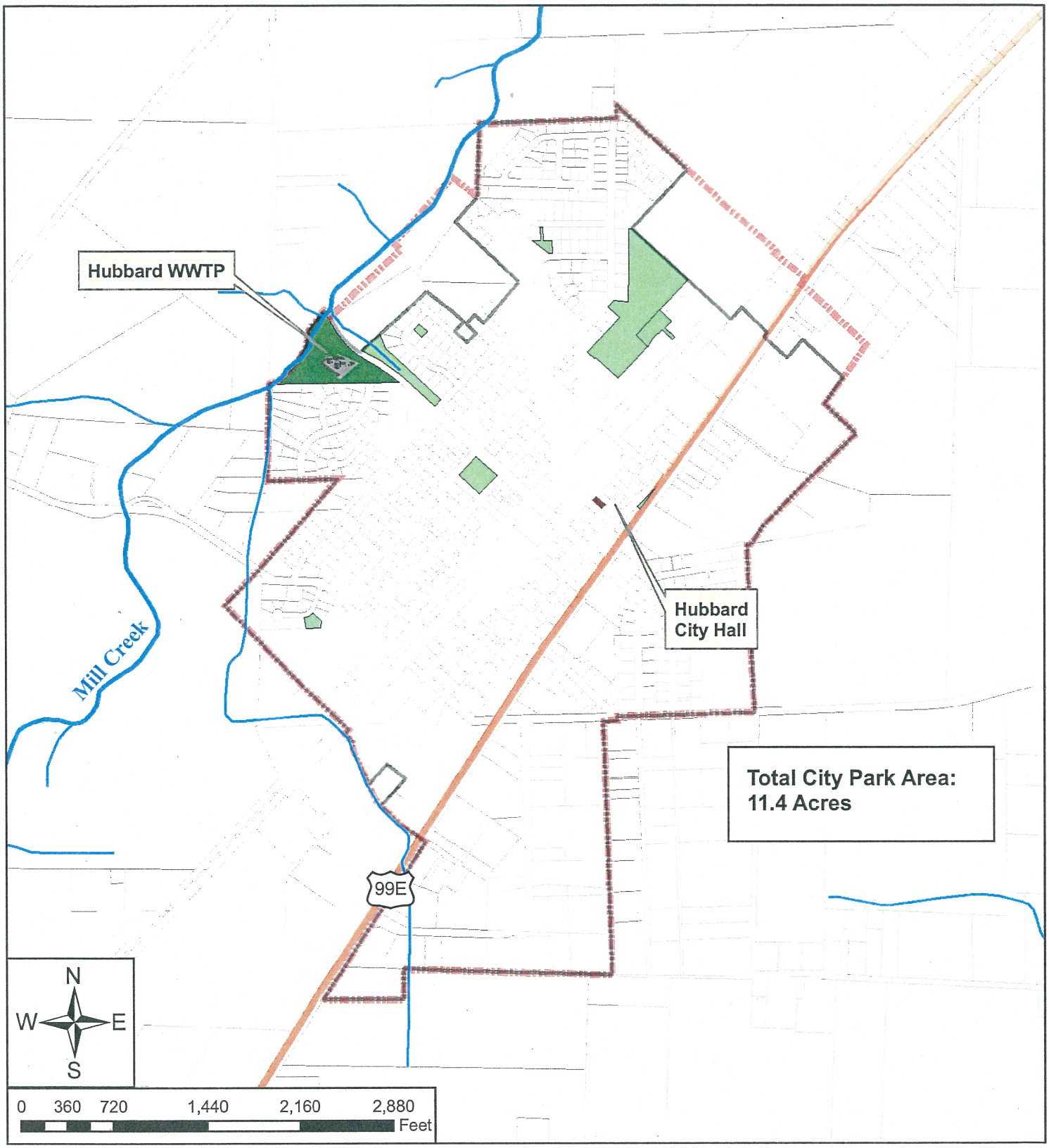
Kennedy/Jenks Consultants

New Subsurface Discharge Outfall
Site Location and Soil Information

Alternate Discharge Alternative Study
City of Hubbard, Oregon

0491011*00

Exhibit 4



Legend

- 2002 Urban Growth Boundary
- City Limits
- Park
- 2004 Hubbard Tax Lot

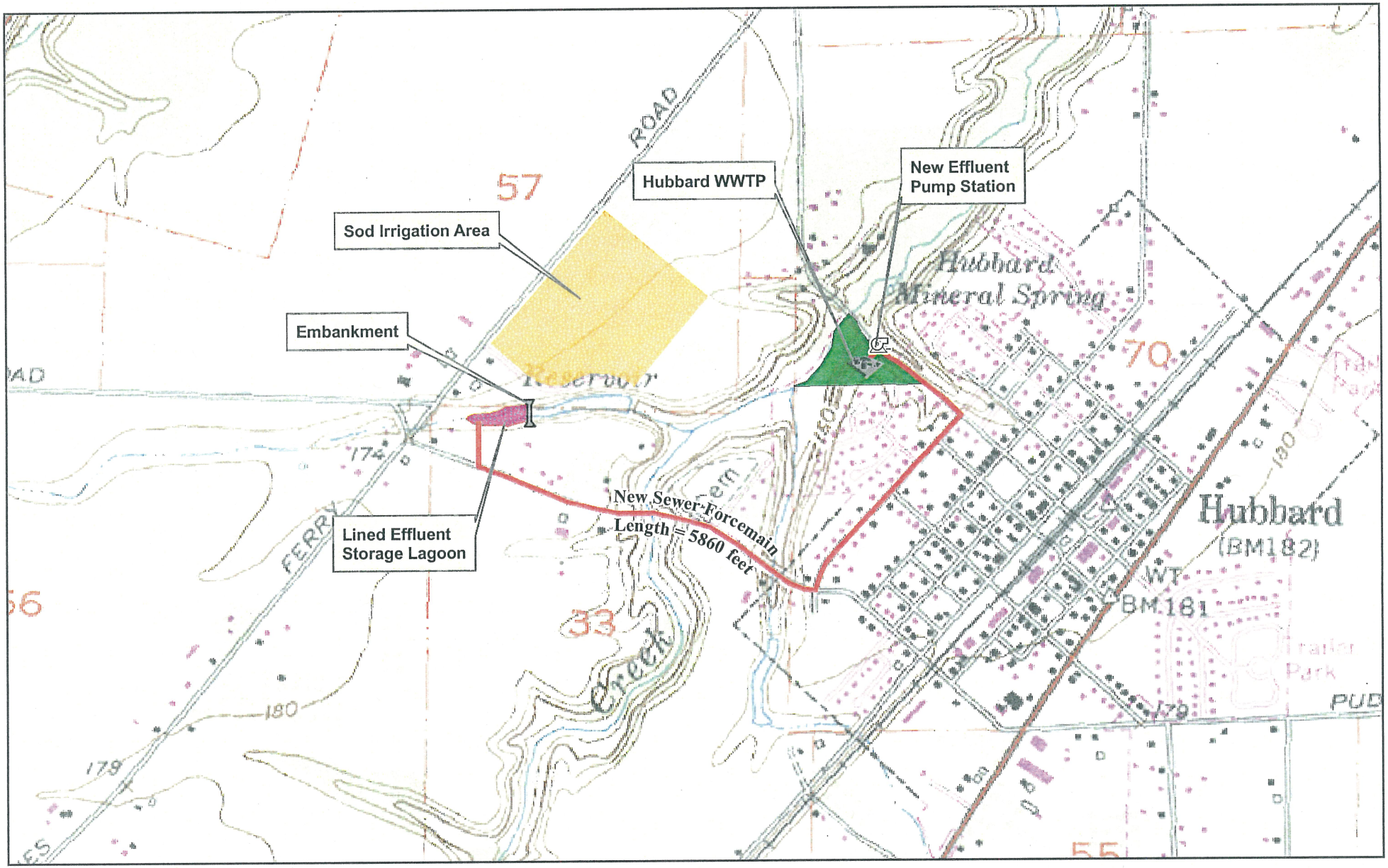
Kennedy/Jenks Consultants

Reclaimed Water Irrigation Alternative
City Park Irrigation Option

Alternate Discharge Alternatives Study
City of Hubbard, Oregon

0491011*00

Exhibit 5



Kennedy/Jenks Consultants

Reclaimed Water Irrigation Alternative
Agricultural Irrigation Option

Alternate Discharge Alternatives Study
City of Hubbard, Oregon

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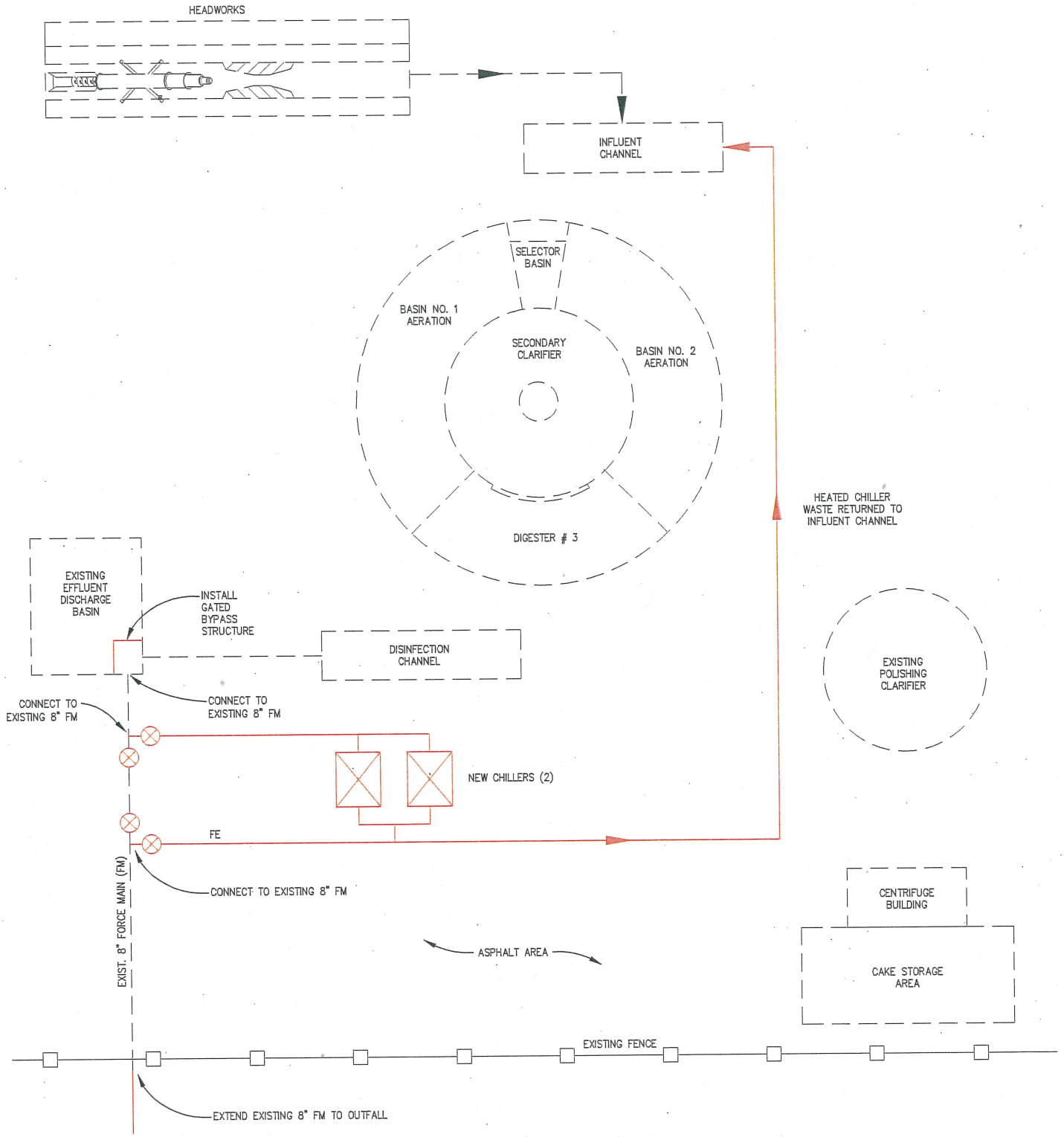
Exhibit 6



Legend

— — —		Existing
———		New/Proposed
FE	=	Final Effluent
CTC	=	Chiller Return

Kennedy/Jenks Consultants

WWTP Chiller Installation
Conceptual Layout

Alternate Discharge Alternatives Study
City of Hubbard, Oregon

Exhibit 7