Final Report

Reconnaissance-Level Source Water Study

Prepared for

Seal Rock Water District

March 2015

Prepared by

GSI Water Solutions, Inc.

Civil West Engineering Services, Inc.

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1. Introduction

The Seal Rock Water District (District) currently obtains its water supply through a water system shared with the City of Toledo. The system uses water from the Siletz River and from Mill Creek Reservoir during periods of high turbidity in the Siletz River. A single 12-inch pipeline conveys the treated water seven miles from the City of Toledo to the District's service area.

In the event of a major earthquake, it is highly probable that the District's existing pipeline from Toledo would fail, which would leave the District without a water supply. In addition, the District is experiencing more frequent periods when source water is unavailable due to man-made and natural occurrences.

For these reasons, the District is exploring alternative sources of water supply for use as a primary water source. The initial step in this process is to conduct a reconnaissance-level source water study (Water Supply Study). A team of consultants (Consultant Team) was formed to conduct this reconnaissance level study. The Consultant Team included: GSI Water Solutions Inc. (GSI), Civil West Engineering Services, Inc. (Civil West), and Jordan Ramis P.C.

The District's current and future water supply needs provide critical context for the Water Supply Study. **Table 1** below depicts the District's current (2012) average day demands (ADD) and maximum day demands (MDD), as well as its estimated future ADD and MDD for the year 2035. (These demands are presented in both gallons per day (gpd) and cubic feet per second (cfs).)

Table 1. Current and Future District Water Demands.

	Current Demands (2012)		Future Demands (2035)	
	gpd	cfs	gpd	cfs
ADD	320,000	0.5	538,000	0.83
MDD	512,000	0.79	1,173,000	1.82

2. Water Supply Study Process

The following is a summary of the process used by the Consultant Team and the District the Water Supply Study.

2.1 Initial Guiding Principles

At the beginning of the District's Water Supply Study, the Consultant Team met with the District's Board in August 2014 to develop guiding principles. From this meeting, an initial set of management objectives and guiding principles were developed. These objectives and principles were reviewed and revised during the course of the Water Supply Study, and the final versions are described below.

2.2 Selection of Sources for Evaluation

As an initial step, the District, Civil West, and GSI made a preliminary selection of the water sources (streams) for which an analysis would be conducted. This selection was based on sources for which the District already had an existing water right or sources that appear to have sufficient supply to meet the District's water supply needs. The streams included in this preliminary selection were: Henderson Creek; Thiel Creek; Hill Creek; Collins Creek; and Beaver Creek. Small lakes in the area of Lost Lake were also considered. The group then conducted a site visit to view the sources included in the preliminary selection. As a result of the site visit, Hill Creek and Collins Creek were excluded from further evaluation due to insufficient stream flow, poor water quality and poor access to the creeks. The small lakes in the area of Lost Lake were also excluded due to poor water quality and insufficient water quantity. Drift Creek (tributary to the Alsea River) was added to the list of streams under consideration. Thus this Water Supply Study evaluates the following four streams: Henderson Creek; Thiel Creek; Beaver Creek; and Drift Creek.

2.3 Public Involvement

The District engaged the public in its Water Supply Study using several mechanisms. First, the District provided a description of the process in a bill insert that was sent to all District Customers in December 2014. In addition, the District invited key stakeholders to a briefing on December 8, 2014. The District presented information about the four water sources that it was evaluating and requested input on these sources from the stakeholders. The majority of the input was provided by the Oregon Department of Fish and Wildlife (ODFW), the Mid Coast Watershed Council and the Wetlands Conservancy. The District also had individual meetings with local ODFW staff and Department of Environmental Quality (DEQ) staff to obtain additional information about these agencies' potential concerns about fish and fish habitat, including water quality, in the four source streams under consideration. (The bill insert, invitation to the stakeholder briefing, and a meeting summary are provided in **Appendix A** - Public Outreach.)

2.4 Project Objectives and Review Criteria

The project objectives and the review criteria that would be used to evaluate the four sources of supply were reviewed and revised by the District's Board on several occasions. The final objectives and review criteria adopted by the Board are provided in **Tables 2 and 3** below.

Table 2. Project Objectives.

Objective	Definition
High water quality	Water that meets or exceeds existing/future water quality standards as identified by state regulations.
Sustainable water supply	Water source will provide water supply throughout the year.
Resilient water supply / minimize risks	Water supply expected to be able to provide water supply during droughts and after natural disasters
Meet current & future water demands	New source would provide the District with sufficient water supply to meet its current and projected 20-year maximum day demands.
Minimize environmental impacts	The project would limit impacts to the natural environment to the maximum extent possible.
Local control	Provide the District with control over the infrastructure used to divert, treat and convey water supply to the District's distribution system.
Cost effective water supply	Supply that will provide sustainable source water, while providing a cost benefit to District customers.
Implementable	Project can be completed within a reasonable time and budget, and without undue regulatory complexity.

Table 3. Project Review Criteria.

Criteria	Definitions
Water quality	**Meaning:** Refers to raw water quality and the ability to treat water to meet the quality standard of water currently being delivered to District customers. **Rationale:** The location with higher quality source water will be preferred due to the easier and less costly treatment required to meet the current standard.
Supply sufficiency	**Meaning:** Refers to the quantity and reliability of source water available at the location and its sufficiency in meeting current and future demands. **Rationale:** The preferred location will have the more reliable and sufficient supply of water to meet current and future demands.
Resiliency/Risk Analysis	**Meaning:** Refers to identifying the risks associated with a natural disaster such as earthquake, flood, tsunami, etc. or human activity **Rationale:** The preferred location will offer favorable geography and stable history that would indicate lower vulnerability to the effects of natural disasters.
Environmental impacts	**Meaning:** Refers to the frequency and seriousness of anticipated environmental impacts to be encountered in the construction and/or operation of the supply system and the difficulty involved in mitigating those concerns. **Rationale:** The preferred location will present fewer and relatively less serious obstacles to overcome in order to properly protect the environment during construction and operation.
Construction costs	**Meaning:** Refers to all anticipated costs associated with construction of the supply system. **Rationale:** The preferred location will have characteristics (geography, accessibility, etc.) that are conducive to prudent, reasonable, effective management of construction costs.
Operations and maintenance costs	**Meaning:** Refers to all reasonably foreseen costs associated with operation and maintenance of the supply system. **Rationale:** The preferred location will have characteristics (geography, accessibility, etc.) that are conducive to prudent, reasonable, effective management of operations and maintenance costs.
Regulatory complexity	**Meaning:** Refers to the anticipated complexity involved in acquiring all regulatory approvals based on known or suspected conditions and characteristics of the location. **Rationale:** The preferred location will have features that regulatory agencies view as more favorable for construction and operation of a supply system, therefore simplifying the approval process.

3. Summary of Technical Memoranda

In addition to the summary of the stakeholder meeting, the Consultant Team also produced draft technical memoranda to support the Board's decision making process. The memoranda described the water right permitting process, regulatory considerations and engineering aspects associated with developing a water supply, and source water assessment for each of the four sources evaluated. As further described below, the draft memoranda were revised based on input from the Board at its February 12, 2015 meeting. A summary of the final memoranda is provided below.

3.1 Water Rights Evaluation of Source Water Options

The Water Rights Evaluation memorandum developed by GSI considered the potential opportunities for the District to secure authorization to use water from each of the four sources. (The Water Rights Technical Memorandum is provided in Appendix B.) To use water for municipal purposes requires a water right from the Oregon Water Resources Department (OWRD). The water right mechanisms considered included using any existing water right held by the District, obtaining a new water use permit, and obtaining an existing water right currently held by another water user. The memorandum also considered the water supply that would likely be available from each of the sources. The following is a summary of the results of these evaluations. (A summary of the four sources is also provided on page 23 of the Water Rights Technical Memorandum in **Appendix B**.)

Henderson Creek. The District holds an existing water right for use of up to 1 cfs from Henderson Creek. Use of this existing right would be the preferred water right mechanism. The flows in the creek during the summer months are, however, too low to meet the Districts current or future ADD or MDD.

Thiel Creek. The District does not have an existing water right on Thiel Creek and obtaining an existing right through a water right transfer is not feasible. The water right permitting approach would, therefore, be to obtain a new water use permit. Although OWRD considers the creek to have sufficient water availability to issue a new permit for year-round use, the flows in the creek can be quite low in summer months and would be insufficient to meet the District's future MDD. Additionally, ODFW expressed concern that use of water from Thiel Creek during low flow months could have potential impacts to the habitat of fish listed under state and federal Endangered Species Acts (ESA).

Beaver Creek. The preferred water right mechanism for use of water from Beaver Creek would be to obtain a new water use permit. OWRD considers the creek to have water available to issue a new year-round permit and the creek has sufficient flows to meet the District's current and future ADDs and MDDs year-round. Although ESA-listed fish are present in Beaver Creek, local ODFW staff did not expect the District's proposed use to impact these fish or their habitat. It is worth noting that there is high public interest in Beaver Creek, and stakeholders suggested that if Beaver Creek is the

selected source, it should be limited to use by District customers only. This high public interest and close collaboration would be important factors in the permitting process.

Drift Creek. The water right mechanism for the District's proposed use of water from Drift Creek would be a new water use permit. OWRD would not, however, issue a permit for year-round use. Due to water use by existing water rights, the agency would find that there was not water available for a new water use permit during the months of October and November. A new permit would, therefore, only allow use from December through September. The flows in the creek are expected to meet the Districts current and future demands during these months. ESA-listed fish are present in Drift Creek, and local ODFW staff expressed concerns about impacts on these fish from new diversions of water.

3.2 Engineering Analysis of Raw Water Alternatives

The technical memorandum developed by Civil West evaluated multiple engineering components necessary for development of a new water source, and included cost estimates associated with each source of supply under consideration. (The Civil West Technical memorandum is presented in **Appendix C**.) The following is a summary of these engineering evaluations:

Henderson Creek. The District has an existing in-water structure on Henderson Creek, which would require repairs and modifications to make it a functional intake structure. The water treatment plant would require a relatively small system capacity due to low flows available in Henderson Creek. The existing location on Henderson Creek has some benefits as well as some risks. The location would allow a relatively easy connection from the treatment plant to the District's water system. The point of diversion is, however, in a relatively urban area, which could result in a relatively high risk of vandalism. The proposed site is not within the 100-year flood plain or in a tsunami inundation area, but there is some possibility of damage to the facilities due to earthquakes or landslides.

The draft memo reported a construction cost of approximately $4.7 million and an annual operations and maintenance cost of approximately $326,000. These cost estimates were revised in the final memo. The estimated cost of construction of facilities at Henderson Creek was the lowest of the four options considered (approximately $5.1 million), and had the lowest annual operation and maintenance cost (approximately $130,000). Finally, the net present value was determined to be $9.9 million for the Henderson Creek source.

Thiel Creek. The three possible alternatives for constructing an intake on Thiel Creek are an instream intake structure, shallow wells adjacent to the stream, or an infiltration gallery. Civil West anticipates a treatment plant at this location would require a mid-range capacity due to seasonally fluctuating flows in Thiel Creek. Similar to Henderson Creek, Thiel Creek offers relatively easy connection between the point of diversion, water treatment plant location and the existing water

system. Due to its relatively isolated location, risks associated with vandalisms are considered low. There is some possibility of damage associated with natural disasters. The evaluated location for an intake structure is within the flood plain and tsunami inundation area, but the water treatment plant would be outside of this area. (Modifications to these facilities could, however, minimize impacts from flooding or tsunamis.)

The draft memo reported a construction costs for the Thiel Creek facilities of approximately $5.4 million and annual operations and maintenance costs of approximately $400,000. These cost estimates were revised in the final memo. The revised cost of construction of facilities at Thiel Creek was estimated at approximately $5.9 million, and the annual operation and maintenance cost was estimated at approximately $204,000. The Thiel Creek facility was determined to have a net present value of approximately $8.3 million.

Beaver Creek. The possible intake methods considered for Beaver Creek were shallow wells adjacent to the stream, and an infiltration gallery. Two potential locations on the creek were evaluated. These locations would require transmission piping between 100 and 600 lineal feet to connect with the District's water system. Beaver Creek is expected to have more water available for use than Henderson or Thiel Creek, so a greater treatment plant capacity is anticipated. Since the intake structure is expected to have limited above-ground exposure, the risk of vandalism is expected to be reasonably low. There is, however, a possibility of damage associated with natural disasters. Similar to Thiel Creek, the water treatment facility would be outside of the flood and tsunami inundation zone, but the intake structures would be within these zones. (Modifications to these facilities could, however, minimize impacts from flooding or tsunamis.)

The draft memo reported construction costs for Beaver Creek of approximately $6.7 million and annual operations and maintenance costs of approximately $400,000. These cost estimates were revised in the final memo. The revised cost of construction of facilities at Beaver Creek was estimated at approximately $ 7.4 million, and the annual operation and maintenance cost was estimated at approximately $210,000. The net present value for the Beaver Creek facility was determined to be approximately $9.1 million.

Drift Creek. Two locations on Drift Creek were considered, but one site received a limited analysis because it is in a remote location and offers limited space. The possible intake methods evaluated were shallow wells adjacent to the stream and an infiltration gallery. The point of diversion locations under consideration would require approximately 7.8 miles of transmission lines to connect to the District's water system. The long transmission lines increase their susceptibility to damage from earthquakes and landslides and create more opportunities for power outages. Additionally, the higher pressure in the pipeline could increase the chances of failure. While the remote locations of the intake and treatment facilities would be expected to reduce the likelihood of vandalism, the locations are expected to increase the cost and complexity of permitting and constructing the facilities. The location of these facilities could also expose them to risks from natural disasters. The intake facilities would be within the flood zone and tsunami inundation area,

but they could be modified to minimize damage. The treatment facilities would be outside of these areas.

The remote location of the Drift Creek facilities would also affect estimated project costs. The original estimated construction cost was approximately $16.1 million and annual operations and maintenance cost was approximately $400,000. The revised costs in the final memo are approximately $14.5 million for construction costs, which is substantially higher than capital cost estimate for other sources, and the annual operation and maintenance cost was estimated at approximately $201,000. The net present value of the Drift Creek facility was also the highest for all of the considered alternatives at approximately $13.3 million.

City of Toledo. The final memo included a "no-action" alternative in which the District would continue to obtain its water supply from the City of Toledo. The existing water system that the District currently shares with the City of Toledo is subject to possible damage as the result of a natural disaster. The water system obtains water supply from both Mill Creek and the Siletz River. The intake sites on Mill Creek and Siletz River are within the flood plain, and long pipelines convey water from the sources to the City of Toledo. Landslides and power outages pose threats to these facilities. The greatest threat to the system is, however, the 7-mile long transmission line to the District, which could break as the result of a natural disaster. The line passes through areas that are prone to landslides and flooding, and are in tsunami inundation zones.

The estimated capital costs for this alternative totaled approximately $9.3 million. The estimated annual operation and maintenance cost for this alternative, at approximately $378,000, was higher than that for the four other evaluated sources of supply. The net present value of this alternative was determined to be approximately $9.8 million.

3.3 Source Water Assessment of Source Water Options

The Source Water Assessment memorandum developed by GSI briefly described the zoning and tax lot ownership of the lands in each of the four watersheds under consideration. (The Source Water Assessment memorandum is provided in **Appendix D**.) Land uses within Henderson and Thiel Creek watersheds were primarily municipal with timber use in the headwaters. Some land in the Beaver Creek watershed is owned by the Oregon Department of Parks and Recreation and is used for recreation and conservation purposes, but the majority of the lands were found to be primarily agricultural uses at lower elevations and forest lands in the uplands. Similarly, the lands in the Drift Creek watershed are primarily agricultural lands and timber lands. The memorandum described typical contaminants often associated with the identified types of land uses, but the reconnaissance level analyses revealed no major, identifiable threats to the four potential water supply sources that would preclude conducting further investigation into their use.

4. Selection of Water Supply Source

The final steps in this reconnaissance-level study of source water alternatives were for the District's Board to objectively evaluate the sources using a set of criteria and to adopt the report documenting the Water Supply Study process, which includes the memoranda summarized above.

4.1 Adoption of Initial Criteria Evaluation

During its February 12, 2015 meeting, the Consultant Team presented to the Board summaries of the information that was developed during the Water Supply Study and as described in the draft memoranda described above. Based on this information, an initial Criteria Evaluation table was developed for ranking the four water supply sources under consideration. Using the previously developed review criteria (described in Table 3), the Board considered scores for each of the four sources being evaluated. A scale of 0 to 4 was used, with the highest score assigned to the source most likely to meet each criterion. Two of the review criteria (supply sufficiency and construction costs) were weighted at twice the value of other criteria. As shown in the table in **Appendix E**, the ranking in the initial Criteria Evaluation of Water Supply Options (dated 2/12/ 2015) resulted in Beaver Creek receiving the highest total score (28) and Drift Creek receiving the lowest score (10). Thiel Creek and Henderson Creek received total scores of 23 and 20, respectively. The Board voted to adopt the initial Criteria Evaluation of Water Supply Options (dated 2/12/2015) for use in selecting a water source to meet the District's current and future water demands.

4.2 Adoption of Final Criteria Evaluation

As previously described, the draft memoranda on which the rankings were developed were subsequently modified based on input from the Board. These changes were relatively minor revisions that did not affect the source option scores adopted by the Board on February 12, 2015. Nonetheless, the Criteria Evaluation of Water Supply Options was updated to reflect the final construction costs, and operations and maintenance costs included in Civil West's final memorandum. (See **Table 4** below.)

During its March 12, 2015 meeting, the Board reviewed and adopted the revised Criteria Evaluation of Water Supply Options dated March 12, 2015.

4.3 Adoption of Executive Summary

During its March 12, 2015 meeting, the Board reviewed the Executive Summary for the Seal Rock Water District Water Supply Study. The Board approved the Executive Summary and appendices as appropriately documenting the Water Supply Study process and results.

5. Summary

After a deliberate and objective evaluation process, the District's Board voted to continue the study of Beaver Creek as a primary water source option.

Table 4. Revised Criteria Evaluation of Water Supply Options

Final Criteria Evaluation of Water Supply Options (March 12, 2015)

Criteria	Henderson Creek	Thiel Creek	Beaver Creek	Drift Creek
Water Quality	Treated water quality is expected to be comparable to the District's current treated water. Specific source water quality concerns due to location (Highway 101; treated sewage disposal).	Treated water quality is expected to be comparable to the District's current treated water. No specific source water quality concerns.	Treated water quality is expected to be comparable to the District's current treated water. No specific source water quality concerns.	Treated water quality is expected to be comparable to the District's current treated water. No specific source water quality concerns.
	2	**4**	**4**	**4**
Supply Sufficiency (x2)	Limited supply due to low stream flow. Future ADD available November--May; Future MDD available only Dec.--March	Limited supply due to low stream flow. Future ADD available year-round, future MDD available November--June.	No supply limitation. Future ADD & MDD available year-round.	Supply limited due to water right restrictions. Future ADD & MDD available December--September.
	0	**2**	**4**	**0**
Resiliency/Risk Analysis	High risk associated with manmade threats; possible damage associated with natural disasters	Low risk associated with manmade threats; risk associated with floods and tsunamis	Low risk associated with manmade threats; risk associated with floods and tsunamis	Low risk associated with manmade threats; risk associated with floods and tsunamis, risk associated with landslides and power outages, risk of transmission line breaks
	1	**3**	**3**	**1**
Environmental Impacts	No ESA-listed fish, some small wetlands impacted	ODFW has concerns about ESA-listed fish. Likely impacts to wetlands.	ESA-listed fish present but local ODFW staff does not expect impacts, impacts to wetlands expected, possible complications due to state natural area, and ongoing mitigation and restoration efforts.	Local ODFW staff has concerns about ESA-listed fish, extensive pipelines expected to cause environmental impacts, and complications possible due to ongoing restoration efforts by U.S. Forest Service.
	3	**1**	**3**	**1**
Construction Costs (x2)	$5,128,240 (lowest cost)	$5,948,480 (16% higher)	$7,447,600 (45% higher)	$14,478,880 (182% higher)
	3	**3**	**2**	**0**
Operations and Maintenance Costs (annual)	$130,121	$203,810	$209,690	$201,112
	4	**3**	**3**	**3**
Regulatory Complexity	New water right not required. No ESA-listed fish. Potential permitting required due to impacts to wetlands, which may require mitigation.	New water right required. Local ODFW staff has concerns about ESA-listed fish habitat. Likely permitting required based on impacts to wetlands, which may require mitigation.	New water right required and high public interest in Beaver Creek. ESA-listed fish present but local ODFW staff does not expect impacts. Likely permitting required due to impacts to wetlands, which may require mitigation.	New water right required. Water supply limited due to water right restrictions. Local ODFW staff has concerns about ESA-listed fish and the instream water rights. Potential extensive permitting associated with transmission line. Potential permitting associated with instream impacts.
	4	**2**	**3**	**1**
Totals	**20**	**23**	**28**	**10**
4 = source(s) most likely/best suited to meet criteria 0/1 = source(s) unable/least likely to meet criteria				

Appendix A
Public Outreach

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Water Supply Update

December 2014

Seal Rock Water District Source Water Evaluation Project

Seal Rock Water District's current sources:

Seal Rock Water District's water currently comes from the Siletz River, and Mill Creek, a tributary of the Yaquina River.

The District and the City of Toledo share a water treatment facility and treated water flows from the City of Toledo to the Seal Rock Water District through a 7-mile pipeline.

What is the problem?

In the event of a major earthquake, the pipe that connects the City of Toledo and the Seal Rock Water District is likely to fail, and the District would be without water.

What is being done?

Seal Rock Water District has begun an evaluation to develop a primary source of supply for District customers.

During this process, potential new water supply sources within the District will be identified, and evaluated to see if they could be used as a resilient supply of water to meet the District's current and future water needs.

What water sources are being evaluated?

The District has identified the following streams as potential water supply sources that are being evaluated:

- Henderson Creek
- Thiel Creek
- Beaver Creek
- Drift Creek (tributary to Alsea River)

What are the long-term goals of the source water evaluation?

Identify a water source that will provide the District with a safe, sustainable and resilient water supply.

How to learn more:

- Attend Board meetings on the 2nd Thursday of each month
- Contact the District at 541-563-3529 for more information
- Read future updates that will be provided by Seal Rock Water District on our website at www.SRWD.org
- Schedule a project briefing for your group or HOA regarding this project, or other District projects by contacting the District.

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PO Box 190 · 1037 NW Grebe Street · Seal Rock, Oregon 97376
Phone: 541.563.3529 · FAX 541.563.4246 · Email: info@srwd.org

Seal Rock Water District

Date: November 21, 2014

To: Mid Coast Stakeholder Group

From: Seal Rock Water District

RE: District Source Water Evaluation

Dear Stakeholder

Please accept this invitation to attend a briefing hosted by the Seal Rock Water District (District) to receive information regarding a source water evaluation currently in process.

The District Board of Commissioner's has directed the General Manager to complete a source water evaluation of area water sources that could serve the community of Seal Rock. District staff and a technical team of engineering and water resources consultants have initiated the evaluation. The District would like to take this opportunity to invite you to attend a project briefing on December 8th, beginning at 1:00 pm in the Seal Rock Water District Board Room, located at 1037 NW Grebe Street, Seal Rock, OR. 97376.

The District is exploring alternative sources of water supply for use as a primary water source. In the event of a major earthquake, it is highly probable that the District's existing pipeline from the City of Toledo would fail, which would leave the District without a source of water. The Districts main source of water supply currently comes from a Point of Diversion on the Siletz River shared with the City of Toledo. The District is also experiencing more frequent periods when source water is unavailable due to manmade and natural occurrence.

In an effort to accommodate your availability, by now, recipients of this letter would have received a phone call from the District providing notification for this event. If your schedule will not accommodate this meeting please feel free to delegate this event to someone that can represent your Department/Agency.

For your convenience a District profile is provided as an attachment to this invitation for your review. Feel free to contact me if you have any questions.

Sincerely,

A Denlinger

Adam Denlinger
General Manager

Adam Denlinger, General Manager
adenlinger@srwd.org
www.srwd.org

District Profile:

SRWD is within and serves a significant portion of Lincoln County. The county is the second largest of Oregon counties, with a 2012 population of 49,000 which represents an increase of 4.9% since 2007. Customer growth for the District has grown by 1% over the same five year period. The District's service is largely residential, with some commercial business centered on tourism which have contributed significantly to the economy of the County. Future growth potential for SRWD's service area is expected to be in single family housing, apartments, and condominiums.

SRWD is the largest water District on the Oregon Coast and is located in Lincoln County, between Newport and Waldport. The current boundaries of the District were formed in 1956 by the merger of two separate contiguous water districts when SRWD received its municipal articles of incorporation.

SRWD obtains all source water through a single pipeline conveying water from the City of Toledo. A master meter records the quantity of water sent to and purchased by the District. The quantity of water purchased by the SRWD represents half of the water sold by the City of Toledo. During peak use months the water supply comes from the Siletz River and during winter/high turbidity events the water supply is from Mill Creek.

General Statistics:

- 9 fulltime employees
- Service territory: 13 square miles
- District population: 5000 +
- Service connections: 2400
- Customer base: 94.5% residential & multifamily; 5.5% commercial/industrial/government
- Water sales (volume): 70.1% residential & multifamily; 29.5% commercial/industrial/government; 0.04% wholesale.

Water System:

- Average Daily Demand: 0.5 CFS.
- Maximum Daily Demand: 0.8 CFS
- 2.5 million gallons stored in reservoirs
- 7 pump stations
- 60 Miles of pipeline
- Annual water loss 17%

Existing District Water Rights:

The District currently holds water right certificate 21390 for the use of water from Henderson Creek. Certificate 21390 authorizes the use of up to 1.0 cfs for year-round use for municipal purposes. Additionally the District currently holds water right certificate 32199 for use from the Districts original point of diversion on Hill Creek. Certificate 32199 authorizes the use of up to 0.5 cfs for year around municipal purposes. Finally, the District holds Permit S-40277 which authorizes the use of 2.6 cfs from the Siletz River.

Adam Denlinger, General Manager
adenlinger@srwd.org
www.srwd.org

Alternative and Emergency Water Sources:

In addition to the water curtailment plan developed in Section 7.0 of the 2014 Water Management & Conservation Plan (WMCP), the District desires an established source water connection to serve as a primary water source. The frequency of mudslides and the possibility of earthquakes and tsunamis make it prudent for the District to thoroughly evaluate how it will best serve its customers in the event of manmade or natural disasters.

The District currently has a connection to the City of Newport. At the present time, this connection allows SRWD to provide Newport with water in emergency situations. Because the connection is not hydraulically adequate for Newport to provide Seal Rock with emergency water, the District is planning improvements, including a booster pump station and PRV, which will allow mutually beneficial use of the existing connection. The connection with the City of Newport will, however, only provide water supply on an emergency basis. The City of Newport does not have sufficient water supply to meet the District's future water demands.

The WMP evaluated the potential for a connection to the City of Waldport to the south. Waldport is connected to other agencies south of the District, creating a network of regional connectivity that provides multiple agencies with backup water in case of emergency. Though this intertie could not provide the District with water on a long-term basis, it would serve as another avenue to mitigate risks to the District in case of a water supply shortage.

Adam Denlinger, General Manager
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Seal Rock Water District

Seal Rock Water District Source Water Evaluation Stakeholder Briefing

December 8, 2014

Alternative Supply Sources under Evaluation

1. Henderson Creek
   a. District holds existing water right for 1 cfs (.65 mgd)
   b. There is only 1 other small existing water right on Henderson Creek; no instream water right
   c. Estimated natural stream flows range from 0.23 cfs (.15 mgd) in September to 3.4 cfs (2.2 mgd)in February[1]
   d. Additional water available for new permits only November through May[1]
   e. Basin program rules allow new municipal use water rights

2. Thiel Creek
   a. Estimated water available ranges from 1.01 cfs (0.65 mgd) in September to 18.30 cfs (11.8 mgd) in February.[1]
   b. There are 4 small water rights on Thiel Creek and its tributaries; no instream water right
   c. Water available for new permits year-round[1]
   d. Basin program rules allow new municipal use water rights

3. Beaver Creek
   a. Estimated water available ranges from 11.4 cfs (7.4 mgd) in September to 157.0 cfs (101.4 mgd) in February.[1]
   b. There are 22 existing water rights on Beaver Creek and its tributaries; no instream water right
   c. Water available for new permits year-round[1]
   d. Basin program rules allow new municipal use water rights

4. Drift Creek
   a. Two potential locations for a point of diversion: just below Wheelock Creek and approximately 2 miles upstream from Wheelock Creek
   b. There are 10 existing water rights on Drift Creek and its tributaries; 3 are instream water rights that protect between 15 cfs (9.7 mgd) in August and September and 130 cfs (84 mgd) in November and December.
   c. Estimated water available:
      i. Below Wheelock Creek (at mouth): ranges from 23.3 cfs (15.1 mgd) in September to 320 cfs (207 mgd) in February
      ii. Above Wheelock Creek: ranges from 21.6 cfs (14 mgd) in September to 303 cfs (196 mgd) in February
   d. Water available for new permits only December through September (excludes October and November)[1]
   e. Basin program rules allow new municipal use water rights

We want your input

Please send your comments to Adam Denlinger at adenlinger@srwd.org by December 22, 2014

[1] According to the Oregon Water Resources Department's water availability estimation at 80% exceedance.

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February 6, 2015

To: Adam Denlinger, Seal Rock Water District

From: Adam Sussman, GSI Water Solutions, Inc.

RE: Stakeholder Meeting Summary

On December 8, 2014, the Seal Rock Water District (District) held a stakeholder briefing as part of its Source Water Evaluation project. The purpose of the meeting was to provide stakeholders an update on the project and to seek input regarding the water sources under consideration. The meeting invitation and background material provided are in **Attachment 1.** Below is a brief summary of the stakeholder input received at the meeting and in follow-up correspondence. The majority of input was provided by the Oregon Department of Fish and Wildlife, the Mid Coast Watershed Council and the Wetlands Conservancy.

Henderson Creek

- The District may want to modify its existing water right on Henderson Creek so that the authorized place of use covers the entire District.

- The City of Newport disposes its sewage sludge (solid waste) near the airport, which is in close proximity to Henderson Creek. This activity is not well regulated and may need to be addressed before initiating use of this source.

- Cutthroat trout may be present on Henderson Creek.

Thiel Creek

- Given the potential subsidence associated with a subduction-zone earthquake, the location identified for diverting this source may become "intertidal" after such an event.

- The Oregon Department of Fish and Wildlife would likely suggest conditions on any new water use permit from Thiel Creek to limit use in the summer months due to low stream flows and concerns about impact to fisheries (coho salmon).

Beaver Creek

- Given the potential subsidence associated with a subduction-zone earthquake, the location identified for diverting this source may become "intertidal" after such an event.

- The District should look at water quality data developed by the U.S, Geological Survey (USGS) that suggests high salinity at the diversion location being considered for Beaver Creek.

- The District should look at water quality data developed by Lincoln County Soil and Water Conservation District. These data show high levels of dissolved oxygen in the upper reaches of Beaver Creek.

- Previous recovery plan studies for coho salmon have identified Beaver Creek as an important location; a stream that is important to the general health of coastal coho salmon.

- Beaver Creek is an important component of the Beaver Creek State Natural Area.

- Concerns were expressed that diverting water from Beaver Creek could warm the water within the wetlands and warm the denser salt water near the mouth of the creek.

- There is lots of activity in the Beaver Creek watershed to restore and enhance wetlands; Simpson Creek is an area of current focus. Interest was expressed in partnering with the District on restoration/acquisition projects.

- Water withdrawal from Beaver Creek should be limited to use by District customers only.

Drift Creek

- The District should look at a location on Wheelock Creek; a location above the waterfall. Lyndon Creek may be an option too.

- The presence of spring chinook salmon on Drift Creek elevates concerns about fisheries impacts.

- The U.S. Forest service has completed lots of restoration work on lower Drift Creek. The District should be aware of previous restoration efforts.

General Comments

- Interest was expressed in conditioning any "new" water use permit acquired by the District so that use would be limited to the District only.

- Interest was expressed in the District leasing/transferring its Siletz River water use permit to instream use.

- Interest was expressed in the District evaluating other source options – Hidden Lakes, Hill Creek, and Collins Creek.

- The District should consider source water protection issues in its analysis.

- Appropriate management of watershed areas can assure clean water and reliable supply. Coastal fog and associated fog drip from trees is an important consideration.

- The District should also be considering winter storage and more raw water storage.

- A mechanism should be in place so that water freed-up from the Siletz River (by the District having a local source) should not become an additional source for the City of Newport.

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Appendix B
Water Rights Technical Memorandum

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Water Solutions, Inc.

Technical Memorandum

To: Adam Denlinger, Seal Rock Water District

From: Adam Sussman, GSI Water Solutions, Inc.
Kimberly Grigsby, GSI Water Solutions, Inc.
Owen McMurtrey, GSI Water Solutions, Inc.

Date: March 5, 2015

Re: Water Rights Evaluation of Source Water Options for Seal Rock Water District

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1. Introduction

GSI Water Solutions, Inc. (GSI) developed this technical memorandum to provide a water rights review of the source water options being considered by the Seal Rock Water District (District). As further described below, six potential sources of supply were identified. Four of these sources were analyzed as potential opportunities for the District to obtain an alternative water supply.

The District currently obtains its water supply through a water system shared with the City of Toledo. The system uses water from the Siletz River and from Mill Creek Reservoir during periods of high turbidity in the Siletz River. (The District holds water use permit S-40277, which authorizes the use of up to 2.6 cubic feet per second (cfs) from the Siletz River for municipal purposes. The City of Toledo holds water rights from the Siletz River and Mill Creek.) A single 12-inch pipeline conveys the treated water seven miles from the City of Toledo to the District's service area.

The District is exploring alternative sources of water supply for use as a primary water source. In the event of a major earthquake, it is highly probable that the District's existing pipeline from Toledo would fail, which would leave the District without a water supply. In addition, the District is experiencing more frequent periods when source water is unavailable due to man-made and natural occurrences. The District is developing an emergency intertie with the City of

Newport but the city does not have sufficient water supply to provide water to the District on more than a very short-term emergency basis.

The District serves water to primarily commercial and domestic accounts. According to the District's 2013 Water Management and Conservation Plan, it served 2,489 housing units. Using the county average of 1.65 persons per housing unit, this would equate to a service population of 4,107. As is common on the coast, the occupancy rates increase significantly during the summer months. The District estimates that it serves a population of approximately 5,175 during the summer. The peak summer population was estimated by assuming a 90 percent occupancy rate and an average population of 2.31 people per occupied unit.

As part of its water supply planning, the District has determined it's current (2012) average day demand (ADD) and maximum day demand (MDD). The District has also estimated its demand for indoor water use (based on the lowest monthly demand from March 2012). The District has estimated its future demands for the year 2035. (The ADD and MDD projections are from the District's Water System Master Plan.) These demands are presented in Table 1 below. The demands are presented in both gallons per day (gpd) and cubic feet per second (cfs). (All conversions from gpd to cfs assume water is diverted at a constant rate 24 hours per day.)

Table 1. Current and Future District Water Demands.

	Current Demands (2012)		Future Demands (2035)	
	gpd	cfs	gpd	cfs
ADD	320,000	0.5	538,000	0.83
MDD	512,000	0.79	1,173,000	1.82
Indoor Use	262,580	0.41	289,500	0.45

1.1. Regulatory Background

In Oregon, with a few exceptions, the use of public water requires a water right from the Oregon Water Resources Department (OWRD). Prior to issuing a water use permit, OWRD will determine whether the proposed water source has been withdrawn from further appropriation, and then review the permit application according to the following criteria:

1) whether water is available;
2) whether the proposed use is consistent with its "basin program" rules;
3) whether the proposed use would cause injury to an existing water right; and
4) whether the proposed use is consistent with other rules of the Water Resources Commission.

If OWRD is able to make a positive finding for each of the above review criteria, it establishes a presumption that the proposed use is in the public interest. In addition, OWRD must determine, based on completion of a Land Use Information Form by the applicable local land use authority(ies), that the proposed use is consistent with the local comprehensive land use plan. OWRD can then issue a proposed final order proposing to approve the application. If the agency is unable to make a positive finding for each criteria (for example, if water is not available some months), the public interest presumption is not established and OWRD typically denies the application. There is a process by which OWRD can make a number of findings to determine that the proposed use is in the public interest, even though not all of the criteria are met, but this is an extremely rare occurrence.

After issuing a proposed final order, the agency provides public notice of its intent to issue a permit (or deny the application). The public has an opportunity to protest the agency's proposed decision. Any third party can file a protest to the agency's order. The basis of the protest can be very broad and can include public interest issues such as objections to potential impacts to fish habitat or water quality. Before OWRD can issue a final order and permit, a protest must be resolved, either through negotiation, or through an administration hearing and possibly judicial review.

When OWRD issues a permit, it describes the amount of water that can be used,[1] the point of diversion, the type of water use, and the place of use. A permit also describes the water right's priority date, which is typically the date the application is filed. Water rights with the oldest (most senior) water right can continue to receive water during times of low stream flow when water rights with more recent priority dates (junior water rights) are required to stop diverting water.

Permits describe the timeline for making full beneficial use of the water. New municipal use permits generally have a twenty-year time limit to develop the use (initiate and complete construction and make full beneficial use of the water). If the water right holder completes its development of the water by this deadline, it can develop a claim of beneficial use report and request a water right certificate. If a water right holder needs more time to develop the right, it may request an "extension of time" from OWRD.

The holder of a water right must apply to OWRD to change any of the elements of their water right. A permit holder can request a change to the point of diversion, and, under limited circumstances, the place of use, through a "permit amendment" process. The holder of a certificate can request a change to the point of diversion, place of use, and type of use through a "transfer" process. OWRD reviews applications for transfers and permit amendments to determine whether they will cause injury to existing water rights or enlarge the right to be changed. For a water right transfer of an existing certificated water right, generally the right to be transferred must be a valid water right; not subject to forfeiture due to non-use.

[1] The amount of water may be expressed as a volume (usually in acre-feet) or as a rate (usually in cubic feet per second). 1 cubic foot per second = 448.8 gallons per minute = 0.646 million gallons per day.

1.2. Water Rights Analysis Process

The goal of this water rights analysis is to determine whether the District has, or could obtain, a water right authorizing the use of water from each of the identified source to implement an alternative water supply. GSI also compared the available water supply from each source to the District's current and projected future demands. Finally, GSI considered other water-related regulatory issues associated with use of water from each source. The following is a description of the process used to develop the water rights analysis contained in this technical memorandum.

As an initial step, the District, Civil West Engineering, and GSI staff made a preliminary selection of the water sources (streams) for which an analysis would be conducted. This selection was based on sources for which the District already had an existing water right or sources that appear to have sufficient supply to meet the District's demands. The streams included in this preliminary selection were: Henderson Creek; Thiel Creek; Hill Creek; Collins Creek; and Beaver Creek. Small lakes in the area of Lost Lake were also considered.

The group then conducted a site visit to view the sources included in the preliminary selection. As a result of the site visit, Hill Creek and Collins Creek were excluded from further evaluation due to insufficient stream flow, poor water quality and poor access to the creeks. The small lakes in the area of Lost Lake were also excluded due to poor water quality and insufficient water quantity. Drift Creek (tributary to the Alsea River) was added to the list of streams under consideration. Thus this water rights analysis evaluates the following four streams: Henderson Creek; Thiel Creek; Beaver Creek; and Drift Creek.

The second step in the process was to evaluate the District's ability to obtain a water right authorizing the use of water from each of the water sources. GSI considered the opportunity to obtain this authorization under three scenarios: 1) under an existing water right held by the District; 2) by obtaining a new water use permit; and 3) under an existing water right acquired from another water right holder through a water right transfer.

Existing Water Right Held by District

GSI first considered the District's ability to develop an alternative source of supply using water rights that the District currently holds. The District holds a water right only on Henderson Creek.

New Water Use Permit

GSI next evaluated the District's ability to obtain an alternative water supply by applying for one or more new municipal water use permits. To determine whether the District could obtain a new water use permit authorizing the use of water from the identified source streams, GSI

evaluated the source according to the review criteria used by OWRD when processing a water right application.

A. Withdrawals

First, GSI determined whether the water source has been withdrawn from appropriation. None of the sources under consideration have been withdrawn from further appropriation.

B. Land Use Compatibility

As part of its review of a permit application, OWRD must confirm that the proposed use will be consistent with the local comprehensive plan. To this end, the agency requires applicants to submit a Land Use Information Form completed by each local land use jurisdiction with authority over the locations of the proposed point of diversion, conveyance system, and place of use. The completed forms must indicate that the proposed use is either allowed outright or, if a discretional land use approval is required, that the land use approval is being pursued or has been obtained. Based on a preliminary review of the zoning for the proposed sources, it appears that a discretionary land use approval may be required for any of the evaluated sources. An in depth evaluation of land use requirements should be a component of the next phase of study.

C. Water Availability

Next, GSI determined whether water was available for the proposed use. GSI reviewed OWRD's online water availability report system for each stream. OWRD uses an 80 percent exceedance standard to determine whether water is available for a new "live flow" water right.[2] After considering the estimated natural flow and prior demands from existing water rights, OWRD considers whether water is available for the proposed new use 80 percent of the time (or 8 out of 10 years).

D. Basin Program Rules

GSI also considered whether the basin program rules would preclude or limit issuance of a new permit for each source. OWRD and the Oregon Water Resources Commission (Commission) have divided the state into a number of administrative basins, and have adopted a set of administrative rules that pertain to each basin. These rules are referred to as "basin programs" and identify uses that are allowed, or not allowed, from the water sources within the basin. (Allowed uses are referred to as "classified" uses.) When processing an application for a new water use permit, OWRD determines whether, according to the relevant basin program rules, the proposed use is a classified use for the proposed water source. All of the source streams under consideration are in OWRD's administratively established Mid-Coast Basin. GSI reviewed the basin program rules for the Mid-Coast Basin to determine whether each source was classified for municipal use. GSI also reviewed other rules in the basin program to identify

[2] OWRD typically determines whether water is available for a new storage right using water availability at 50 percent exceedance.

any other potential limitations.[3] It is worth noting that the basin program rules allow issuance of new water rights if they are conditioned that "any effluents or return flows from the use shall not interfere with other beneficial uses of water."

E. Other Rules of the Water Resources Commission

The third step was to evaluate whether the District's use of water would be consistent with other rules of the Commission. Typically, the most relevant "other rules" are the Division 33 "Additional Public Interest Standards for New Appropriations" rules. Under the Division 33 rules, OWRD is required to coordinate with other state agencies, including the Oregon Department of Fish and Wildlife (ODFW) and the Oregon Department of Environmental Quality (DEQ), before issuing a new water use permit. These agencies typically provide input and often recommend permit conditions to protect the habitat of fish species listed as sensitive, threatened or endangered by ODFW or under the federal Endangered Species Act. In some cases, these conditions can make the development of the source very difficult or impractical. For example, ODFW could recommend curtailment of use when stream flows drop below a certain level to protect fish movement. In some cases, DEQ has suggested conditions to limit diversion due to concerns about impacts to water temperature and associated fish impacts. However depending on the site, there may be opportunities for an applicant to provide mitigation (either on-site or off-site) that will offset impacts to the habitat resulting from the project.

F. Injury

OWRD's final review criterion for a new water use permit application is whether the proposed use would cause injury to existing water rights. "Injury" means precluding another water right from receiving the water to which it is entitled. Since a new surface water use permit would be junior in priority to all other existing water rights on the stream, OWRD will conclude that it cannot injure other existing water rights. For this reason, the source analysis for each stream (below) does not discuss the "injury" review criteria, but discusses each of the other review criteria in more detail.

Existing Water Rights Held by Other Water Users

Finally, GSI evaluated whether the District could obtain the alternative water supply that it seeks by acquiring one or more existing water rights held by other water holders, and changing the water right, through the transfer or permit amendment process, to authorize the District's use of water for municipal purposes. To determine whether other water rights were available for acquisition on each stream, GSI reviewed OWRD's on-line water right information system and searched for all surface water rights on the streams, and their tributaries, being evaluated. For each water right identified, GSI noted the maximum authorized rate and the beneficial use(s) of water allowed by the water right. Finally, GSI made some general assumptions about

[3] The basin Mid-Coast basin program contains a rule that states: "…structures or works [that] do not give cognizance to the multiple-purpose concept are further declared to be prejudicial to the public interest." Although the exact meaning of this rule is not entirely clear, in our experience, it has not precluded the issuance of new water use permits from the Mid-Coast basin.

the feasibility of acquiring and transferring an existing water right. GSI assumed that water rights authorizing the use of water for domestic purposes and for small areas of irrigation (most likely for garden and landscape watering) were unlikely to be available for acquisition. (To make a final determination of whether a particular water right could be transferred to municipal use, an evaluation of the status of the water right, particularly whether any of the right had been used during the last five years would need to be conducted. This more detailed evaluation was, however, beyond the scope of this initial reconnaissance level review.)

Evaluation

As a final step, GSI analyzed the amount of water supply that would likely be available under each approach and compared that water supply to the District's existing and projected future water demands. GSI also described any other potential, water rights or water-related regulatory limitations identified for each of the water supply sources evaluated.

2. Water Rights Analysis of Water Supply Alternatives

The following section summarizes GSI's evaluation of each of the four water supply sources evaluated: Henderson Creek, Thiel Creek, Beaver Creek, and Drift Creek. For each water source, GSI provides a description of the water source and an analysis of the District's potential opportunity to obtain an alternate water supply using three water right options: an existing District water right (if applicable), a new water use permit, or an existing water right held by another water user. For the water right option appearing to provide the greatest opportunity for the District, the memorandum describes the portion of the year during which each water source could meet the District's current and projected future water demands.

2.1. Henderson Creek

2.1.1. Source Description

Henderson Creek drains an approximately one square mile area located between the City of Newport and the Newport municipal airport. The creek is located just north of the Surfland subdivision. The creek flows westward a distance of approximately two miles to the ocean. (See map in Attachment 1.)

The District has an existing diversion dam on Henderson Creek. (This was one of the original water supplies for the District but has been out of service for several years.) The location of the existing point of diversion is located just west of Highway 101, and is close to the municipal airport.

There are no gages or known field measurements for Henderson Creek, so predicting stream flows for the creek with any certainty is difficult. According to OWRD's online water availability report system, the estimated natural stream flow at 80 percent exceedance ranges

from 0.23 cfs in September to 3.4 cfs in February. OWRD generally estimates the natural flow in a watershed using gage data from the watershed at issue or a regression analysis from a similarly situated gaged watershed. Table 2 describes the natural stream flows that OWRD estimates for Henderson Creek.

Table 2. OWRD Estimated Natural Stream flow in Henderson Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Natural Flow	2.90	3.40	2.96	1.60	1.09	0.46	0.37	0.26	0.23	0.32	1.25	2.96

2.1.2. Existing District Water Right

The District currently holds water right certificate 21390 for the use of water from Henderson Creek. Certificate 21390 authorizes the use of up to 1.0 cfs for year-round use for municipal purposes. The certificate describes the authorized place of use as the "platted area of Surfland Unit No. 1" and the residence of Paul F. Murphy. (We understand that this place of use was incorporated as part of the District in 1964.) The District could, however, use this water right to serve water to areas outside of the Surfland Unit No. 1 because a "water supplier" can serve water to lands not described within its water right's authorized place of use so long as certain conditions are met.[4] Moreover, even though the District has held this water right in reserve for many years, under Oregon law, municipal water right certificates are generally not subject to forfeiture for non-use.

For Henderson Creek, the best estimate of the supply from the creek available to meet projected demands is OWRD's estimated natural flows in Henderson Creek at 80 percent exceedance (from Table 1). GSI compared these flows to the 1 cfs rate authorized by the District's water right Certificate 21390, and found that the creek would typically have this much flow during the months of November through May.

Demand Met From Existing Water Right. GSI also compared the projected flow available to the District under its existing water right to meet current and projected future demands. The following is a summary of that comparison.

Current Demands

- Indoor: November—June
- ADD: November—May
- MDD: November—May

[4] The use outside of the place of use must be for municipal purposes and cannot "interfere with or impair prior vested water rights."

Future Demands

- Indoor: November—June
- ADD: November—May
- MDD: December—March

Other Considerations Associated with the Existing Water Right. The District has an existing structure in Henderson Creek to facilitate water diversion. We understand that the structure will need to be modified or replaced. The need for fish passage is triggered when an artificial obstruction is constructed in a stream with migratory fish. As further discussed below, ODFW staff have indicated that Henderson Creek has cutthroat trout, which ODFW considers a native migratory fish. Consequently, modification or replacement of the diversion facility may trigger the need for fish passage.

In addition, there may be some water quality concerns related to Henderson Creek. We understand that the City of Newport land applies solid waste on property near the airport. Due to its proximity to Henderson Creek, these activities could potentially impact water quality in the creek.

2.1.3 New Water Use Permit

Availability of Water. According to OWRD's online water availability report system, water is available from Henderson Creek for new appropriations of "live flow" from November through May each year. Water is not available for a new live flow water right from June through October. (For a year-round use such as municipal use, OWRD will not grant a new water right from a source that does not have water available year-round unless the applicant can demonstrate that it can meet its demands under another water right. Thus, an application for a new permit would need to articulate how the District would meet its water needs during the summer months without the use of the new permit.) OWRD's water availability for Henderson Creek at 80 percent exceedance is described in Table 3.

Table 3. OWRD Water Availability in Henderson Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Is Water Available?	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes

Limitations Due to Basin Program Rules. Henderson Creek is within the Mid-Coast Basin. The applicable basin program rules "classify" Henderson Creek for a limited number of purposes, including municipal use. The basin program rules do not, therefore, provide an impediment to the District obtaining a new water use permit, and no other limitations in the basin program rules were identified.

Limitations Due to Other Administrative Rules/Fish Habitat and Passage Issues. As previously described, OWRD's Division 33 rules provide an additional public interest review for new appropriations of water to determine whether they will impair or be detrimental to sensitive, threatened or endangered fish species. OWRD sends all permit applications for the use of surface water to its Interagency Review Team, which includes ODFW and the DEQ. These agencies provide recommendations for protecting habitat of sensitive, threatened and endangered fish. Typically, the recommendations take the form of permit conditions, but the agencies can also recommend denial of an application.

According to ODFW staff, cutthroat trout are present in Henderson Creek. ODFW characterizes this fish as a "species of concern" but it is not listed under either the federal or state endangered species act (ESA). ODFW did not identify any "listed" fish in Henderson Creek. Since the Division 33 rules relate to impacts to sensitive, threatened or endangered fish species, we would not anticipate ODFW's and DEQ's Division 33 reviews for a new permit to appropriate water from Henderson Creek to result in any additional conditions to protect listed fish.
As previously noted, fish passage may be triggered if a new diversion structure would need to be placed in the stream. As also described above, the City of Newport is land applying solid waste to land near the airport, which could impact water quality in Henderson Creek.

Opportunities and Supply Associated with a New Permit. Due to limited water availability, the authorized season of use for a new water use permit from Henderson Creek would be limited to November through May. (The District's permit would be junior in priority to only one very small water right, so the reliability of the right would depend almost exclusively on the amount of natural stream flow.) OWRD's estimated natural flows for Henderson Creek suggests that obtaining a new water right would provide little (actual) additional water supply beyond what the District can already obtain under its existing right.

2.1.4 Acquire Existing Water Rights

OWRD's online water rights information system identifies only one other existing water right for the use of water from Henderson Creek and its tributaries. (See list of water rights in Attachment 1.) Certificate 84519 authorizes the use of up to 0.006 cfs for "domestic use expanded for one household." This very small domestic water right is likely not available for acquisition and transfer.

2.1.5 Source Summary

From a water rights perspective, the District could utilize Henderson Creek as a source of water supply. Utilizing the District's existing water right (certificate 21390) is expected to provide the best water right mechanism for accessing the water from this source.

District's Existing Water Right

- Authorizes use of up to 1.0 cfs, but stream flow is expected to be less than this rate from June through October
- Expected flow available could meet current ADD and 2033 ADD from November through May
- Expected flow available could meet current and future indoor demand from November through June

New Water Right

- Could obtain a new permit for water use only November through May
- Use of a new permit, in combination with the existing water right, could provide sufficient water supply to meet the District's 20-year MDD (1.82 cfs) from December through April (not the months during which the District experiences its maximum demands.)

Other Existing Water Rights

- Only one other very small (0.006 cfs) domestic water right exists on Henderson Creek

2.2 Thiel Creek

2.2.1 Source Description

Thiel Creek is located south of Henderson Creek, in the northern portion of the District. The Thiel Creek drainage area covers approximately four square miles, and flows a distance of approximately six miles through forested areas to the Pacific Ocean. (See map in Attachment 2.)

The potential sites for a point of diversion are located upstream from the confluence with South Fork Thiel Creek. Several options for appropriating water are under consideration, including an intake on the creek, shallow wells adjacent to the creek, and an infiltration gallery.

There are no stream gages and only two miscellaneous field measurements for Thiel Creek, so predicting stream flows for the creek with any certainty is difficult. OWRD's online water availability report system calculates "net water available" (after use of water by existing water rights), and provides an estimation of stream flows. OWRD's net water available in Thiel Creek at 80 percent exceedance is estimated to range from 1.01 cfs in September to 18.30 cfs in February. Table 4 describes these flows for Thiel Creek.

Table 4. OWRD Estimated Net Water Available in Thiel Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Available Flow	15.90	18.30	16.10	8.95	6.26	2.38	1.70	1.11	1.01	1.46	5.95	16.50

2.2.2 New Water Use Permit

The District could apply for a new surface water use permit or groundwater use permit, depending on the mechanism by which the water would be appropriated. A surface water permit would be required for an intake on the creek and some infiltration galleries. A groundwater permit would be required for appropriation from wells and other types of infiltration galleries. In this case, the ability to obtain a groundwater permit would be very similar to the ability to obtain a surface water permit because the groundwater would be in hydraulic connection to the surface water in Thiel Creek and OWRD would consider the groundwater to have "the potential for substantial interference" with the creek. When OWRD determines that a groundwater use will have the potential for substantial interference with surface water, the agency then considers whether water is available and resource constraints of the affected surface water body. Descriptions of the review criterion for both surface water and groundwater permits are described below.

Surface Water Permit

Availability of Water. According to OWRD's online water availability report system, water is available from Thiel Creek year-round at 80 percent exceedance as shown in Table 5.

Table 5. OWRD Water Availability in Thiel Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Is water available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Limitations Due to Basin Program Rules. The Mid-Coast basin program rules "classify" Thiel Creek for a limited number of purposes, including municipal use. The basin program rule classifications do not, therefore, provide an impediment to the District obtaining a new surface water use permit.

Limitations Due to Other Administrative Rules/ Fish Habitat and Passage Issues.

Fish Habitat and Passage - According to ODFW staff, cutthroat trout are present in Thiel Creek and Coho salmon were historically present. Coastal cutthroat trout are not "listed" under the state or federal endangered species act (ESA). Coho are listed as threatened under the federal ESA and are considered sensitive "vulnerable" by the state. The local ODFW biologist that GSI and the District consulted indicated that Thiel Creek has high potential for Coho habitat, and that his primary concern for this creek was maintaining sufficient flow in summer months to allow upstream and downstream fish movement. For example, he indicated that Coho juveniles are migrating out of the stream from March through June. According to ODFW, it is likely that any required mitigation could be off-site due to the type of fish habitat on Thiel Creek. Fish passage requirements may be triggered if a diversion structure would need to be placed in the stream.

Water Quality – According to preliminary discussions with DEQ staff, the agency does not have specific designations or listings regarding water quality in Thiel Creek. Nonetheless, because the creek has low flows in late summer months, DEQ would want to ensure that any new diversion from the creek did not cause the water quality to fail meet temperature standards for which it was previously in attainment.

Groundwater Permit

Availability of Water. We would anticipate that OWRD would determine that groundwater was available for the proposed use. Further, since OWRD would conclude that the proposed use would have "the potential for substantial interference" (PSI) with the creek, the agency would also consider surface water availability. As described above, surface water in Thiel Creek is available year-round.

Limitations Due to Basin Program Rules. The basin program rules do not classify, or place any limitations on, the use of groundwater in the basin. The basin program rule classifications do not, therefore, provide an impediment to the District obtaining a new groundwater use permit.

Limitations Due to Other Administrative Rules/Fish Habitat and Passage Issues. As part of its "Division 33" review, OWRD would coordinate with ODFW and DEQ since the proposed use of groundwater would have PSI with surface water. Comments from these agencies on a new groundwater permit application with PSI are expected to be similar to the comments they would provide for a new surface water application. However, fish passage would obviously not be required for a permit to use groundwater.

Opportunities and Supply Associated with a New Permit. If the District obtained a new water use permit from Thiel Creek the projected flow available could be used to meet the District's current and projected future demands as shown in the following is a summary.

Current Demands

- Indoor: year-round
- ADD: year-round
- MDD: year-round

Future Demands

- Indoor: year-round
- ADD: year-round
- MDD: November – June

2.2.3 Acquire Existing Water Rights

OWRD's online Water Rights Information System shows four existing water rights from Thiel Creek and its tributaries. (See list of water rights in Attachment 2.) These four water rights have a combined maximum authorized rate of 0.08 cfs. The rights authorize the use of water for domestic, motel and irrigation use. Thus, the existing surface water rights on Thiel Creek and its tributaries are very small water rights and most are not likely available for acquisition and transfer.

2.2.4 Source Summary

From a water rights perspective, the District could utilize Thiel Creek as a source of water supply. Obtaining a new permit is expected to provide the best water right mechanism for accessing the water from this source.

New Water Right

- Could obtain a new permit for year-round use
- ODFW may suggest conditions under the Division 33 review process to ensure adequate stream flow for fish movement in low flow months. This could potentially limit the amount of water diversion during these key months.
- Use of a new permit, assuming no limits on diversion, could provide sufficient water supply to meet the District's current demands (ADD and MDD) and the District's 20-year ADD year-round. A new Thiel Creek permit would be expected to meet the District's 20-year MDD (1.82 cfs) from November through June (not the months during which the District experiences its maximum demands).

Other Existing Water Rights

- Other very small water rights (combined maximum rate of 0.08 cfs) exist on Thiel Creek.

2.3 Beaver Creek

2.3.1 Source Description

Beaver Creek is south of Thiel Creek and drains an approximately 34 square-mile area, the majority of which is located in the Siuslaw National Forest. The stream flows westward approximately 42 miles to the Pacific Ocean. The mouth of Beaver Creek is located within Ona Beach State Park. (See the map of Beaver Creek in Attachment 3.)

The District is considering two potential sites for a point of diversion. The first is located just downstream from the confluence with South Beaver Creek and west of South Beaver Creek Road. Two options for appropriating water are being considered: wells constructed adjacent to the creek and an infiltration gallery.

Although there are some reported stream flow measurements on Beaver Creek, they are not sufficient to provide an estimation of stream flows that could be available for appropriation by the District. For this reason, OWRD's water availability information was used to estimate stream flow that may be available for appropriation by the District. According to OWRD's online water availability report system, Beaver Creek's estimated net water available at 80 percent exceedance ranges from 11.6 cfs in September to 157.0 cfs in February. Table 6 describes these flows for Beaver Creek, at its mouth.

Table 6. OWRD Net Water Available in Beaver Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Available Flow	141.0	157.0	142.0	84.8	64.0	24.4	17.9	12.2	11.4	16.2	61.2	153.0

2.3.2 Previous District Water Right

The District previously held water use permit S-36508, which authorized the use of up to 4.69 cfs from Beaver Creek for municipal use. On January 24, 1977, OWRD cancelled permit S-36508 based on a voluntary cancellation authorization from the District.

2.3.2 New Water Use Permit

As previously described, the type of permit required depends on the method by which water is to be appropriated. Wells would require a groundwater permit and an infiltration gallery may require a surface water or a groundwater permit, depending on how it is constructed. We have evaluated the District's opportunity to obtain a permit for the use of water from Beaver Creek consistent with OWRD's review processes. As described above for Thiel Creek, the review criterion for a surface water permit and a groundwater permit are very similar. The following evaluation for each of OWRD's review criteria, therefore, would apply to either a surface water or a groundwater application (with the exception that fish passage requirements not be applicable to a groundwater permit application):

Availability of Water. We anticipate that OWRD would find that groundwater was available for the proposed use. According to OWRD's on-line Water Availability Report System, surface water is available for a new appropriation in Beaver Creek year-round at 80 exceedance. (See Table 7.)

Table 7. OWRD Water Availability for Beaver Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Is Water Available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Limitations Due to Basin Program Rules. The Mid-Coast basin program rules do not "classify" groundwater, and the rules "classify" surface water in Beaver Creek for a limited number of purposes, including municipal use. The basin program rule classifications do not, therefore,

provide an impediment to the District obtaining a new surface water use permit from Beaver Creek or a new groundwater use permit.

Limitations Due to Other Administrative Rules/ Fish Habitat and Passage Issues.

If the District applies for a new permit (surface water or groundwater), ODFW and DEQ are expected to provide input as part of the "Division 33" review. The following considerations are expected to be identified for either type of permit application.

Fish Habitat and Passage - According to ODFW, two "listed" fish species are present in Beaver Creek: Coho salmon (federal threatened), and winter steelhead (state sensitive "vulnerable"). Coastal cutthroat trout are also found in Beaver Creek, but are not a listed species. Winter steelhead are migrating upstream from December through March when Beaver Creek has significant stream flow. ODFW also suggested that stream flows are sufficient for juvenile and adult Coho upstream and downstream movement as well.

Water Quality –We understand that water quality issues on Beaver Creek have been studied. The Lincoln County Soil and Water Conservation District has collected data on dissolved oxygen levels in Beaver Creek upstream from the proposed point of diversion. Additionally, DEQ is in the process of developing "implementation ready" Total Maximum Daily Loads (TMDLs) for the coastal zone management area in the Mid Coast Basin, which will include Beaver Creek. That process has not been completed. Finally, the U.S. Geological Survey has conducted a study on Beaver Creek regarding the interaction of salinity and temperature. Nonetheless, according to preliminary discussions with DEQ staff, a new diversion of approximately 2 cfs of water from Beaver Creek, below the South Beaver Creek Road bridge, is not expected to impact temperature or dissolved oxygen levels.

Other Considerations – The Beaver Creek watershed is an area of high importance to the Mid-Coast Watershed Council and the Wetlands Conservancy. Both groups are actively pursuing projects (and have projects on the drawing board) to improve watershed health.

Opportunities and Supply Associated with a New Permit. If the District obtained a new water use permit from Beaver Creek, the projected flow available could be used to meet the District's current and projected future demands year-round, as shown in the following is a summary.

Current Demands

- Indoor: year-round
- ADD: year-round
- MDD: year-round

Future Demands

- Indoor: year-round
- ADD: year-round
- MDD: year-round

2.3.3 Acquire Existing Water Rights

According to OWRD's on-line water rights database for surface water rights from Beaver Creek and its tributaries, 27 surface water rights exist for the creek. (See table of existing water rights on Beaver Creek and tributaries in Attachment 3.) All of these water rights are relatively small. The majority of these rights are for domestic purposes and authorize the use of between 0.005 and 0.01 cfs. There are also three small irrigation rights that have a combined maximum authorized rate of 0.7 cfs The two remaining water rights authorize the use of up to 0.05 cfs for log pond maintenance, and 1.25 cfs for railroad purposes.

In sum, the existing surface water rights on Beaver Creek and its tributaries, are mostly very small domestic use rights and are not likely available for acquisition and transfer. The 1.25 cfs water right for railroad purposes could potentially provide a source of supply for the District, but even if the water right could be acquired, to transfer the right it would need to have been used in the last five years or otherwise not be subject to forfeiture.

2.3.4 Source Summary

From a water rights perspective, the District could utilize Beaver Creek as a source of water supply. Obtaining a new permit is expected to provide the best water right mechanism for accessing the water from this source.

New Water Right

- Could obtain a new permit for year-round use
- ODFW's and DEQ's preliminary input on Beaver Creek is that there is sufficient stream flows to support additional municipal use and protect listed fish. Close coordination will be needed with the Mid Coast Watershed Council and Wetlands Conservancy.
- Use of a new permit, could provide sufficient water supply to meet the District's current ADD and MDD demands and 20-year ADD and MDD demands year-round.

Other Existing Water Rights

- Other very small water rights exist on Beaver Creek. Most are for 0.005 to 0.01 cfs.
- One right for railroad purposes allows the use of up to 1.25 cfs, but it is unknown whether this right has been used in the last five years or is otherwise not subject to forfeiture (a requirement to "transfer" the right to another use.)

2.4 Drift Creek

2.4.1 Source Description

Drift Creek flows approximately 86 miles to its mouth at Alsea Bay, located southeast of the District. The creek has a drainage area of approximately 70 square miles, which includes portions of the Siuslaw National Forest and the Drift Creek Wilderness. (See the map of Drift Creek in Attachment 4.)

The District is considering two locations on Drift Creek as potential points of diversion. The first location is above Wheelock Creek, and was the location of the point of diversion for the District's water right on Drift Creek that has been cancelled (see below). The other location is just below the creek's confluence with Wheelock Creek. At one time, the U.S. Forest Service had a point of diversion at this location. Two options for appropriating water are being considered: wells constructed adjacent to the creek and an infiltration gallery.

The water available on Drift Creek can be evaluated above and below Wheelock Creek. According to OWRD's online water availability report system, the estimated water available at the mouth of Drift Creek at 80 percent exceedance ranges from no water available for appropriation in October and November to 210 cfs in February. In the water availability basin above Wheelock Creek, the water available at 80 percent exceedance ranges from 16.6 cfs in September to 303 cfs in February. Table 8 describes the estimated water available that OWRD estimates for these two water availability basins in Drift Creek at 80 percent exceedance.

Table 8. OWRD Estimated Water Availability in Drift Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
At Mouth	179.0	210.0	167.0	58.0	31.0	18.6	18.2	10.9	8.27	-59.1	-0.01	135.0
Above Wheelock Creek	273.0	303.0	262.0	159.0	95.7	60.5	35.9	19.1	16.6	28.9	123.0	251.0

As further explained below, the lack of water available for appropriation downstream (at the mouth of Drift Creek) also precludes appropriation of water upstream during the months of October and November.

2.4.2 Previous District Water Right

The District previously held water use permit S-43196, which authorized the use of up to 10 cfs from Drift Creek for municipal use. The permit had a priority date of May 4, 1978. In January 1992, OWRD issued an order approving and extension of time to begin and complete construction and to use the water to October 1, 1994. The order stated that:

> *No further extension of time limits will be considered unless Seal Rock Water District can demonstrate economic and financial benefits in maintaining and developing permit 43196 as compared to agreeing to a cooperative endeavor with adjacent municipal users to create a water supply authority for the purpose of supplying water needs from the Siletz River and other existing permitted sources.*

In September 1995, OWRD issued an order finding that the District had failed to meet the above condition and denying the District's extension application. The order concluded that Permit S-

43196 was valid only to the extent the use was developed as of October 1, 1994. On November 15, 1995, OWRD issued an order cancelling the permit.

Thus, according to OWRD's records, the District no longer holds a permit for the use of water from Drift Creek.

2.4.3 New Water Use Permit

As previously described, the type of permit required depends on the method by which water is to be appropriated. Wells would require a groundwater permit, and an infiltration gallery may require a surface water or a groundwater permit, depending on how it is constructed. We have evaluated the District's opportunity to obtain a permit for the use of water from Drift Creek consistent with OWRD's review processes. The review criterion for a surface water permit and a groundwater permit are very similar and the following description of each of OWRD's review criteria applies to either a surface water or a groundwater permit application:

Availability of Water. According to OWRD's on-line Water Availability Report System, water is available for a new appropriation in Drift Creek (at 80 exceedance) only from December through September of each year. The water availability report shows that two instream water rights (Certificates 59727 and 59579)[5] protect water instream during October and November at rates that match or exceed the estimated natural flows for those months. For example, in the reach above the mouth of Drift Creek, Certificate 59579 protects water instream at a rate of 90 cfs during the second half of October but the estimated natural stream flow for that month is only 30.9 cfs. Similarly the instream water right has a rate of 130 cfs in November, which is equal to that month's estimated natural stream flow. As a result, no water is available for new "natural flow" water rights during the months of October and November. To prevent further over-appropriation during months when water is not available, OWRD also considers water to not be available for appropriation in the upper reaches. As a result, water is not available for appropriation above Wheelock Creek during October and November. Table 9 describes water availability (at 80 percent exceedance) for two water availability basins in Drift Creek.

Table 9. OWRD Water Availability for two portions of Drift Creek at 80% Exceedance (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
At Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Above Wheelock Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

[5] Certificate 59727 and 59579 are for instream flows from the confluence with Wheelock Creek to the mouth of Drift Creek.

OWRD would also consider water to not be available for a new groundwater permit during October and November because the proposed use would have PSI with Drift Creek.

Limitations Due to Basin Program Rules. The Mid-Coast basin program rules do not "classify" groundwater and "classify" Drift Creek for municipal use. The basin program rule classifications do not, therefore, provide an impediment to the District obtaining a new surface water or groundwater use permit from Drift Creek.

Limitations Due to Other Administrative Rules/ Fish Habitat and Passage Issues.

The following considerations are expected to be identified as part of the "Division 33" review of a surface water or a groundwater use permit application for Drift Creek.

Fish Habitat and Passage - According to ODFW staff, there are numerous listed fish species in Drift Creek, including Spring Chinook (state sensitive "critical"), winter steelhead (state sensitive "vulnerable"), and Coho salmon (federal threatened, and state sensitive "vulnerable"). Coastal cutthroat are also present in Drift Creek.

This rich diversity of fish species, combined with the connection to the Alsea system, the existence of several instream water rights on Drift Creek, and the presence of adult spring chinook in the system from May through October, led ODFW to express an overall concern about "new" out-of-stream appropriations from Drift Creek.

Water Quality – According to DEQ, Drift Creek is water quality limited. It is on the 303(d) list of water quality impaired bodies for year-round for temperature impairments. (The year-round temperature criterion is 16 degrees C and the criterion during salmon and steelhead spawning season (September 15 – June 15) is 13 degree C.) DEQ also initiated the TMDL process for Drift Creek, but it is on hold due to a lawsuit.

Other Considerations - Finally, it should be noted that the U.S. Forest Service and the Mid-Coast Watershed Council have been conducting watershed restoration work on the lower reaches of Drift Creek (below Wheelock Falls). The restoration work is focused on restoring freshwater marsh and estuarine habitats, and has mainly consisted of removing dikes, and removing or repairing culverts to restore natural drainage patterns. The restoration also includes invasive species control and late successional forest restoration. These entities consider the area between Wheelock Falls and the Rock Creek Wilderness to be a key riparian corridor.

Opportunities and Supply Associated with a New Permit. If the District obtained a new water use permit from Drift Creek, the projected flow available could be used to meet the District's demands from December through September, as shown in the following is a summary.

Current Demands

- Indoor: December –- September
- ADD: December –- September
- MDD: December –- September

Future Demands

- Indoor: December –- September
- ADD: December –- September
- MDD: December –- September

2.4.4 Acquire Existing Water Rights

According to OWRD's on-line water rights database for surface water rights from Drift Creek and its tributaries, only ten water right certificates exist for those sources. (See table of existing water rights from Drift Creek and its tributaries in Attachment 4.) Three of these water rights are instream water rights, which are held by the Oregon Water Resources Department and protect water instream. The remaining seven water right certificates are small water rights that authorize the use of water for domestic and irrigation uses. The maximum authorized rates on these rights range from a low of 0.005 cfs to a high of 0.37 cfs. These small rights are not likely available for acquisition and transfer.

2.4.5 Source Summary

From a water rights perspective, the District could utilize Drift Creek as a source of water supply. Obtaining a new permit is expected to provide the best water right mechanism for accessing the water from this source.

District Water Right

- OWRD cancelled the District's 10 cfs permit in 1995.

New Water Right

- Could obtain a new permit for use only from December through September
- ODFW's preliminary input on Drift Creek is that this source is of high value for listed fish and additional appropriations would be of concern. Close coordination will be needed with the Mid Coast Watershed Council and U.S. Forest Service, which are actively engaged in watershed restoration projects.
- DEQ's preliminary input on Drift Creek indicated that the agency has concerns about the creek not meeting temperature criteria. Additional analysis would be required to determine if a water withdrawal of approximately 2 cfs would exacerbate existing temperature issues on the creek.
- Use of a new permit, could provide sufficient water supply to meet the District's current demands and 20-year demands from December through September.

Other Existing Water Rights

- Seven, small consumptive use water rights exist on Drift Creek. The combined maximum authorized rate for these rights is less than 1 cfs.

3. **Summary**

GSI conducted a water rights review of the source water options being considered by the District: Henderson Creek, Thiel Creek, Beaver Creek and Drift Creek. For each source, GSI evaluated the District's existing water right (if applicable), the opportunity for the District to obtain a new water use permit, and the potential for the District to obtain water supply from other existing water rights from the source. GSI's evaluation of the District's opportunity to obtain a new permit included consideration of the amount of water available for appropriation, any limitations from the basin program rules, and limitations due to other administrative rules, fish habitat, water quality, or fish passage. The attached table provides a summary of GSI's findings for each of the sources evaluated.

Water Right Evaluation Summary

	Henderson Creek	Thiel Creek	Beaver Creek	Drift Creek
Water right options	• Existing District water right for 1.0 cfs. • New water use permit not feasible • Water right transfer not feasible	• New water use permit • Water right transfer not feasible	• New water use permit • Water right transfer not feasible	• New was use permit • Water right transfer not feasible
Demand source could meet **Current ADD – 0.5 cfs** **Projected ADD -0.83 cfs** **Current MDD – 0.79 cfs** **Projected MDD – 1.82 cfs**	• Limited supply due to low stream flow (0.26 cfs in summer) • Meet current and future ADD November—May • Not expected to meet ADD or MDD June—October	• Limited supply due to low stream flow (1.0 cfs in August/September) • Meet current and future ADD year-round • Potentially meet current MDD • Not expected to meet future MDD July—October	• No supply limits • Meet current and future ADD and MDD year-round	• Supply limited due to water right restrictions • Meet current and future ADD and MDD December – September • No water available for a new permit October--November
Seasonal "water availability" for permitting	• Year-round under existing permit • November – May under new permit	• Year-round, low flows in summer	• Year-round	• December—September only
Resource considerations	• Fish passage requirements • Potential source water quality issues • Low flows	• Habitat/presence of listed fish • Likely permit conditions to ensure fish passage • Likely permit conditions to ensure upstream and downstream fish movement • Likely permit conditions that reduce diversion during low flow months	• Habitat/presence of listed fish • Water quality limited but not likely to result in permit conditions • Active wetland restoration • High public interest in Beaver Creek	• Habitat/presence of listed fish • Likely permit conditions to ensure upstream and downstream fish movement • Likely permit conditions that reduce diversion during certain months • Water quality limited and potential permit conditions to address temperature impacts • Active watershed restoration

Appendix C
Civil West Technical Memorandum

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Seal Rock Water District

Lincoln County, Oregon

Technical Memorandum:
Raw Water Alternatives Analysis

March, 2015

Civil West Engineering Services, Inc.

Civil West Engineering Services, Inc. • 609 SW Hurbert Street • Newport, Oregon 97365

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Seal Rock Water District
Technical Memorandum: Raw Water Alternatives Analysis

March, 2015

1.0 Introduction

1.1 Background

In March 2013, Civil West Engineering completed a second amendment to the Seal Rock Water District's Water Master Plan, which was completed in 2010. The purpose of that amendment was to expand the scope of the Master Plan to include an evaluation of several potential sources of water for the District and to explore the addition of several waterline projects to the District's overall Capital Improvement Plan (CIP). The intent of this Technical Memorandum is to further expand on the potential to develop one or more water sources for raw water use by the District. It will evaluate the multiple engineering components necessary to cultivate these possible raw water sources, as well as provide cost estimates in net present value for each source.

1.2 Purpose and Need

The Seal Rock Water District obtains all of its treated drinking water from the City of Toledo. Raw water is transported to the Toledo Water Treatment Plant (WTP) from the Siletz River in the summer and Mill Creek in the winter. The treated water is then transported from the Toledo WTP to the District via approximately 10 miles of water line.

The Seal Rock Water District (SRWD) water system contains two active storage tanks for treated water, the Lost Creek Storage Tank, constructed in 2005, and the Driftwood Storage Tank, constructed in 1981. The District currently has a total treated water storage capacity of 2.3 million gallons when both functional tanks are full. The Lost Creek tank is filled by the Toledo Pump Station with "on/off" based on water depth signals sent via radio telemetry.

The water lines that transmit treated water to the District are highly susceptible to damage from natural

disasters. Earthquakes, tsunamis, flooding and/or landslides could damage or sever the transmission lines, potentially cutting off the District entirely from its water source. In the event of a severe catastrophe that separates the District from the Toledo water source, the functional water storage tanks would only hold enough water to supply the District's customer's water for 3-5 days.

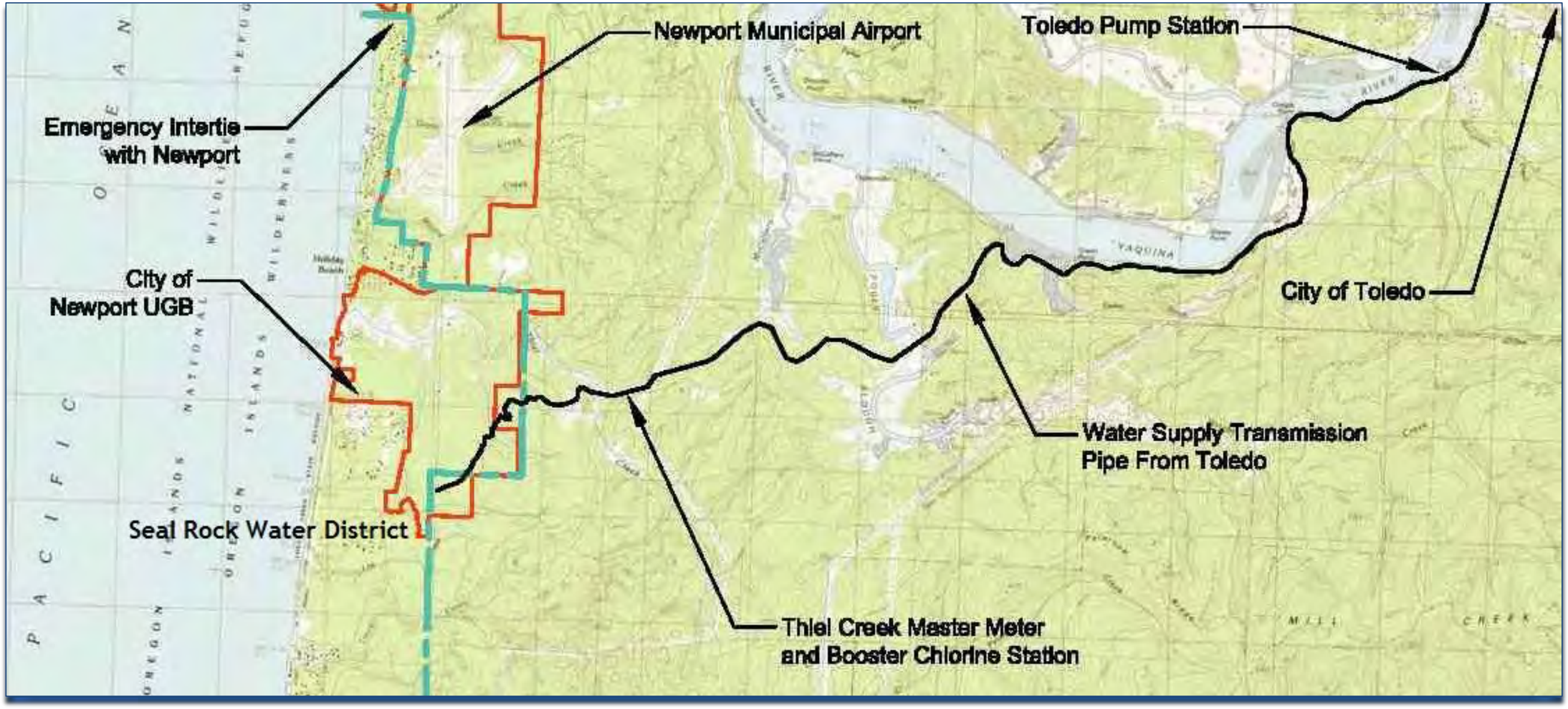
In May, 2013, the District applied for a FEMA grant to install an intertie facility between the District and the City of Newport, located in South Beach, Oregon. The intertie stations' purpose is to provide a redundant water source in case of natural or manmade disasters. The District intends to have the intertie station operational and ready for emergency situations by summer 2015. Also by the summer of 2015, the District expects to be underway with the construction of the Phase 3 Water System Improvements which includes 29,400 feet of new waterline sections placed throughout the District. Over 5 miles of new waterline of various sizes will replace broken, leaking and dysfunctional water lines that the District currently relies upon. There will also be 36 new fire hydrant assemblies installed as well as an automated Meter Read radio system for all meters. The Phase 3 Water System Improvements project is funded in part by the District and USDA Rural Development funds and is designed to reduce water loss and improve overall system resiliency.

The objectives of these water system improvements are to increase the water security of the District by improving the resiliency and the redundancy of the water delivery system. Improving system resiliency will increase the efficiency of the water delivery system as well as increase the protection of the system, particularly in the event of manmade or natural disasters. Creating redundant sources of drinking water, such as the Newport/Seal Rock intertie, will provide the District's customers with safe drinking water in emergency situations.

While these improvements contribute to the water security of the District, the District is still dependent on outside water sources. To satisfy its mandate to provide safe and reliable drinking water to its customers, the District ideally would be able to supply, treat, and transmit drinking water from a water source within the District's boundary.

The goal of this Technical Memo is to explore the general engineering components required to develop prospective raw water sources from within the District's boundary. Civil West Engineering in tandem with GSI Water Solutions, Inc. will explore the technical elements required for the District to potentially develop and maintain their own raw water sources for drinking water supply. From these assessments the District may opt to further explore the development of one or more raw water sources.

Figure 1.2 Waterline Transmission Toledo to SRWD

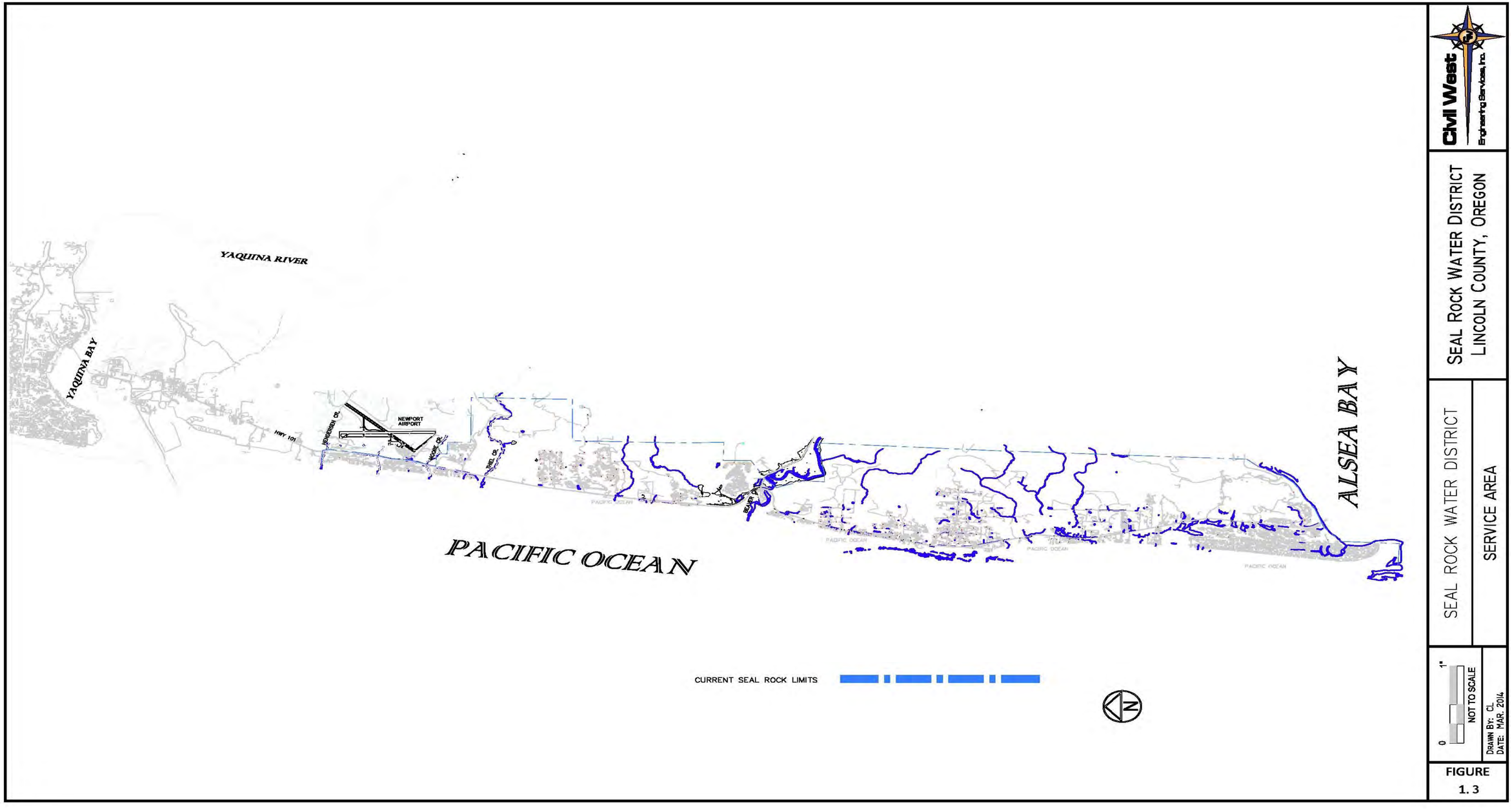


1.3 Service Area

Seal Rock Water District extends from the north side of Alsea Bay at Waldport 11.5 miles northward to Henderson Creek near the Newport Municipal Airport. The District serves the coastline between the cities of Waldport and Newport and at no point extends more than 1.5 miles inland from the coast. The current SRWD Boundary encompasses 6,505 acres or 10.2 square miles.

A current map of Seal Rock Water District can be found on the following page in Figure 1.3.

Figure 1.3-Service Area Map



2.0 Design Criteria

2.1 Raw Water Alternatives Analysis Organization

The Seal Rock Water District, Civil West and GSI have identified six possible raw water sources within the District's boundaries that may have a viable potential to supply drinking water to the District's customers. The creeks evaluated (from north to south) are Henderson Creek, Theil Creek, Beaver Creek, Drift Creek, Hill Creek and Collins Creek. The chain of lakes just north of Waldport, Hidden and Lotus Lake, were also assessed as a potential raw water source. It was determined that Hill and Collins Creeks do not have sufficient stream flows and therefore, will not be evaluated in this Memo. Similarly, Hidden and Lotus Lakes were determined to have insufficient flows along with the high likelihood for water quality issues and therefore, do not receive a full analysis. The potential water supply locations listed in Section 3.0 are presented in order from north to south, beginning with Henderson Creek (south of Newport) and ending with Drift Creek (northeast of Waldport). Finally, a "No Action" option is evaluated, specifically, keeping the status quo of the District purchasing its water from the City of Toledo.

Building a new raw water source involves many technical components. In Section 2.2, we itemize each portion of the development of a water source, from an engineering standpoint, into 13 different subsections/criterion. Each prospective raw water source will be evaluated using these same 13 subsections. Some subsections are very similar for each raw water source, and others vary considerably. The figures associated with each water source show proposed facility layouts as well as illustrate the distribution piping necessary to connect treated water to the water distribution system. One of the objectives of this memo is to provide multiple options for developing a raw water source, so some sites may have more than one component discussed in a criteria section.

Finally, Section 4.0 provides cost estimate summaries for Budgetary Capital Costs for construction, the Annual Operation and Maintenance (O&M) Costs and total costs summarized in Net Present Value (NPV) for each source and for the No Action option of continuing service through the City of Toledo.

2.2 Raw Water Subsection Definitions

Raw Water Intake:

This technical criterion considers alternatives for diverting water at the intake or diversion point. The analysis will consider different types of intakes depending on each site and the condition, if applicable, of any existing structures. One of the goals of an effective intake system is that it should control and reduce turbidity.

The three primary types of intake systems discussed in this Memo are in-stream intake systems, stream side wells and infiltration gallery systems.

In-stream Intake Systems:

Raw water intake can be in the form of an earthen impoundment (diversion dam) in the creek bed. Diversion dams essentially create a "bulge" in the waterway from which water can be diverted efficiently by facilitating water uptake.

Intake screens are designed to remove debris in a channel of flowing water. They protect pumps and other downstream equipment from debris in surface water intakes and other applications. These screens protect and prevent injury to fish and other wildlife that may be found in the stream.

Stream Side Well:

Shallow streamside wells are constructed similar to typical wells. They are constructed close to the stream bank and can take advantage of water that has percolated and been pre-filtered through the soils from the water body. Near the bottom of the well, collector pipes extend radially and horizontally to maximize the collection of groundwater. For this reason, the well does not need to be as deep as wells reaching the water table. The collected water is then pumped from the caisson to the Water Treatment Plant.

Infiltration Galleries:

Infiltration galleries are permeable, horizontal piping into which water can infiltrate from a nearby water source. There are several designs for infiltration galleries. The final design of an infiltration gallery depends on its purpose and the dynamics of the waterway by which it would be installed. A trench is dug, parallel to the direction of flow, deep enough to be below the water table level and is generally below the streambed. The perforated piping is buried under native soils or sand and gravel and is pre-filtered using the natural percolation process of surface water traveling through the water table. The filtered water then travels through the piping to a storage well or sump-well, where it is then pumped to the treatment facility or raw water storage tank. They (infiltration galleries) "are constructed below the water table in an area where there is sufficient recharge to offset the pumping rate and where the permeability of the soil is sufficient to transmit the quantity of water to the existing gallery under the existing head conditions."[1] With optimal permeable alluvial soils and placement adjacent to a waterway and installation, infiltration galleries can be a viable option as a raw water supply/intake. Constructing infiltration galleries adjacent to rivers that experience flooding may remove particulate matter, helping maintain the system.

An example of the use of an infiltration gallery is by the Kernville-Gleneden Beach-Lincoln Beach Water District on the Oregon Coast. The District obtains all of its water from Drift Creek by collecting water via an infiltration gallery and a direct surface intake.[2]

An infiltration gallery would need to be constructed in a manner meeting Oregon Water Resources Department's (OWRD) well construction standards and additional discussions with OWRD are required to obtain well construction specification.

[1] Jurel, Rajvir Singh, Singh Raj Bahadur, et al. "*Infiltration Galleries:-A Solution To Drinking Water Supply For Urban Areas Near Rivers*." ISOR Journal of Mechanical and Civil Engineering. e-ISSN: 2278-1684 Volume 5, Issue 3 (Jan. - Feb. 2013), PP 29-33

[2] CH2MHILL."*Kernville-Gleneden Beach-Lincoln Beach Water District Water Management and Conservation Plan"*. January 2006

Raw Water Transmission:

This component of the analysis will consider alternatives for getting water from the point of diversion (POD) to the treatment plant site. This includes water pipeline as well as pumps to move the raw water from the POD to the Water Treatment Plant site.

Raw Water Storage/Impoundment:

This section will consider the location at each site for the raw water storage. Raw water storage will provide a number of benefits to the Project. Two of the benefits that will directly impact the operation of the treatment plant are equalizing flow for the raw water supply and stabilizing the treatment processes with the attenuation of water quality fluctuations due to rainfall events. An additional advantage of adequate storage will also allow the treatment plant to operate during maintenance activities or upstream blockages on the creek canal and pipelines.

Raw water storage will be in the form of an above ground storage tank. The location of the raw water storage tanks are usually close to the POD but the location may vary depending on the location of floodplains etc.

Water Treatment:

This criterion will consider the potable water treatment processes:

1) Pretreatment: includes screening for large debris, leaves and sticks, and utilizing water storage to promote the settling of fine silts.
2) Secondary Treatment: includes mechanical flocculators and sedimentation basins, chemical coagulation and polymer addition for water clarification.
3) Tertiary Treatment: includes multi-media sand filter or membrane filtration and a chlorine contact basin for finished water disinfection.

Treatment plants can come as prefabricated package Water Treatment Plants that are available in sizes ranging from 125 GPM to 700 GPM. Depending on which package Water Treatment Plant is selected some are required to be contained within a building and some are not. The approximate foot print size will vary and can range anywhere from 300 sf to 1,000 sf depending on the amount of flow to be treated.

The two treatment options for the raw water sources are Conventional Water Treatment Package Plants and Membrane Filtration Package Plans; these are both described in more detail below.

Conventional Water Treatment Package Plant

Integrated conventional Water Treatment Package Plants include the following processes:

- Coagulation
- Flocculation
- Sedimentation
- Filtration
- Chlorination

The package plant uses the biological extended aeration principle of operation. This operation functions by creating an environment with sufficient oxygen levels and agitation to allow for bio-oxidation to treat raw water and make it drinking quality.

The stages of a conventional water treatment package plant occur in four tanks; a flocculation tank, a sedimentation tank, a filtration tank, and a disinfection tank. Before the raw water enters the plant the large solids are removed by the intake screen. Next, the raw water flows into the flocculation tank where a coagulant is injected and floc is formed. The raw water then moves into the sedimentation tank where the floc and solids are allowed to settle to the bottom of the tank. Next the raw water is transferred to the filtration tank were and finally to the disinfection tank where it is treated by chlorination before being discharged from the package plants into the clear-well.

Membrane Filtration Package Plant

A complete water treatment system contains a number of integrated parts and components that allow for the removal, filtration, and disinfection of pollutants from raw water. Membrane filtration plants work through two processes, the first includes a biological process, the second a filtration process. During the biological process small microbes degrade the pollutants in the raw water. Once these pollutants are reduced, they are then filtered out during the filtration phase. The filtration phase occurs in submerged membranes. Finally, the solids that remain are removed to be treated by the solid waste disposal process.

There are two types of membrane filtration processes we will identify as feasible treatment plant options, these are microfiltration and ultrafiltration. Microfiltration uses a membrane with a pore size ranging from 0.1-3 microns, while ultrafiltration uses a membrane with pore sizes ranging from 0.01 to 0.1 micron. Microfiltration is typically used to treat raw water for turbidity reduction, removal of suspended solids, giardia and cryptosporidium. Due to the smaller pore size, ultrafiltration can remove all products that microfiltration can remove in addition to some viruses, color, odor, and some colloidal natural organic matter.

Location of Facilities:

In this section mapping and preliminary layouts for each site will be evaluated. The potential location of the raw water storage area, intake, transmission piping, package treatment plant, clear-well storage, and connection to distribution system will be illustrated. Zoning maps for each source are also provided.

Backwash Facilities:

This section will assess the backwash system options which include; settling tank for sand filter backwash, truck pickup and disposal of sludge from the flocculators and maintenance of these facilities. In connection with the Water Treatment Plant location and design, the disposal of the wastes generated during the various treatment processes must receive careful consideration. Among these wastes are sludge from pre-sedimentation basins, coagulation and/or softening sludge, filter wash water, spent regenerant and rinse water from ion-exchange softeners. Quantities of materials contained in the waste stream will be dependent on the type of treatment processes utilized and the quantity of water treated. A determination of the expected quantity of the various types of waste must be made and proper disposal methods identified during the feasibility/design process.

These types of waste are regulated under RCRA/CERCLA, NPDES, ODOT and local and state ordinances. Depending on the type and amount of discharge waste generated there are several disposal methods see Table 3.1.6.

Table 3.1.6 Treatment Processes and Disposal Methods

Treatment Process	Types of Disposal Methods
Coagulation/Filtration	Landfilling, Disposal to Sanitary Sewer/WWTP, Land Application and Surface Discharge
Precipitative Softening	Landfilling, Disposal to Sanitary Sewer/WWTP, Land Application, Recycling, Surface Discharge
Membrane Separation	Surface Discharge, Deep Well Injection, Discharge to Sanitary Sewer/WWTP, Radioactive Storage
Ion Exchange	Surface Discharge, Evaporation Ponds, Discharge to Sanitary Sewer/WWTP
Granular Activated Carbon	Landfill, Regeneration (on/off site), Radioactive Storage (Return GAC to supplier)

Source: http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2009_tb/water_treatment_DWFSOM49.pdf

Water Distribution:

An evaluation of the connection to the existing distribution system will be provided, including the need for pump boosting of the finished water to match existing pressure zones within the system. This section will also consider pipe routing, constructability, etc.

Treated Water Storage:

Treated water is stored in a clear-water reservoir until it is pumped into the service reservoir for distribution. The minimum capacity must be at least 14 hours average daily flow for storage. These are generally built underground or half above the ground as the storage capacities are quite large.
A preferred option could be to build one tank serving as clearwell and add a second upon expansion of the WTP. Two tanks would be helpful for cleaning/maintenance/painting without impacting the plant because the clearwell doubles as treated water storage.

Controls and Telemetry:

This criterion will evaluate specific controls, telemetry or communication needs for improvement facilities. This would include connecting facilities to the Districts existing system. The District has an existing SCADA (supervisory control and data acquisition) system. This system uses radio telemetry equipment that relays information about flow rates and pressures to the District's main office. It is divided into grids that can be isolated and watched for possible leaks or inaccurate meters, which are then evaluated in the field and fixed if necessary.

Power:

This area will assess power needs, availability, and transmission costs to service new improvement facilities. It will also suggest back-up power options. The WTP would also require a backup, emergency

power supply. This would most likely be in the form of a large diesel generator.

Property Issues:

This section will discuss property needs, easements, and other probable impacts of siting new facilities.

Environmental and Permitting Issues Associated with Infrastructure:

Potential permitting, regulatory and environmental hurdles that could be associated with development of the infrastructure for each site will be provided. This may include fill/removal permitting, wetland delineation and cultural studies, and other issues that could impact the viability and cost of development for a specific alternative.

Risk and Threat Analysis:

Risk and threat analysis is broken down into two parts; risk and threat to infrastructure and risk and threat to water quality. This section will evaluate the possible risk connected with manmade and natural threats such as; tsunamis, flooding, vandalism, timber activities and landslides.

The infrastructure and equipment at each raw water source have a varying level of risk of damage associated with it based on its accessibility by persons and vulnerability to natural disasters.

The threats to water quality at each raw water source could stem from contamination from upstream sources or from point source contamination. Water quality is affected by the overall management practices of the watershed basin. Adjusting land use for the purposes of lessening contaminants, especially soil erosion, pollutants and sedimentation control will be considered.

Geologic hazard maps are provided from Oregon HazVu: Statewide Geohazards Viewer. These maps include the 100-year flood plain, Cascadia Subduction Zone earthquake tsunami inundation zone and landslide areas using data from the Oregon Department of Geology and Mineral Industries (DOGAMI). These maps are for general information and should not be used for specific planning purposes.

3.0 Raw Water Alternatives Analysis

3.1 Henderson Creek Introduction

Henderson Creek is a small stream located on the boundary of the City of Newport and the Seal Rock Water District. Its headwaters are on the east side of Highway 101 and travel below the highway to the west side where it travels a relatively short distance until it meets the ocean. According to the Oregon Department of State Lands it is considered a tidally influenced waterway, even though the outfall at the ocean is disconnected. There is an existing in-water structure that consists of concrete reinforced embankments and a concrete weir at the outlet. The existing structures are not fully functional and in disrepair.

Figure 3.1.a Location Map

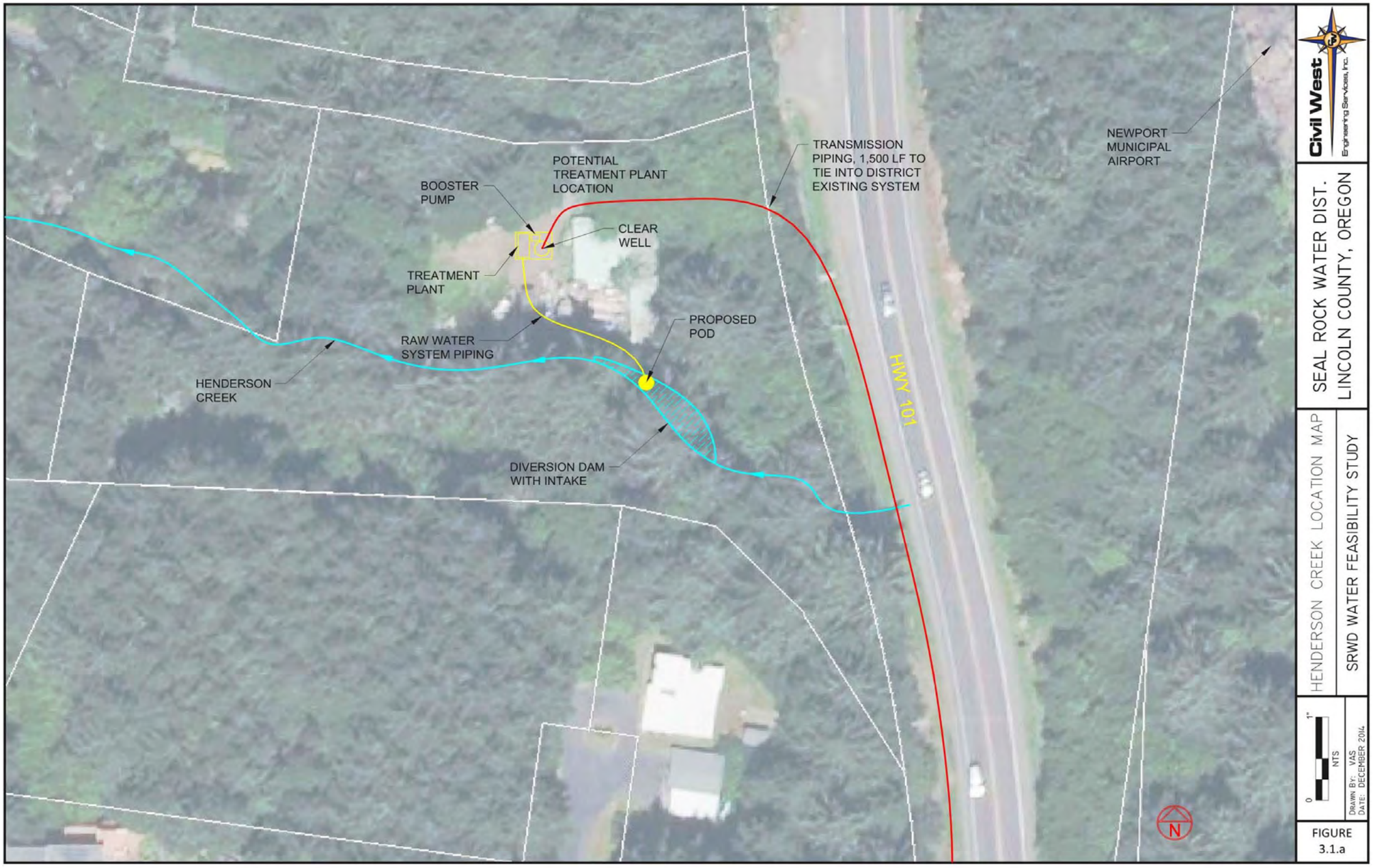


Figure 3.1.b Site Photos

Henderson In-Stream Existing Infrastructure

Existing Infrastructure Bank (Downstream View)

Weir and Overflow (Upstream View)

3.1.1 Raw Water Intake

The suggested site for the Point of Diversion (POD) at Henderson Creek is located in an area on the west side of Highway 101. Figure 3.1.a, is a schematic of the area that shows the location of the existing diversion dam, system piping from the intake to the treatment plant, and transmission piping. The advantage of placing the raw water intake at this location is that this allows for the existing infrastructure to be repaired and used. Structural repairs would include lengthening the walls to increase the volume of water that can be held and repair of the diversion dam bank. The installed intake screen would need to have a self-cleaning feature to help keep leaves and debris from clogging the intake line. The intake transmission line pump itself would need to fluctuate withdrawals based on water availability in the stream. During months of lower water levels, the intake pump would have a variable speed feature to fluctuate the pumping rate based on water availability.

Due to the possible presence of Cutthroat Trout in Henderson Creek, safe, timely and effective fish passage and screening may need to be implemented. The intake screen will need modifications, such as an end of pipe or pump intake screen, to deter juvenile fish from being impacted by the intake suction.

3.1.2 Raw Water Transmission

Raw water transmission for this site would be from the Point of Diversion to the treatment plant and would incorporate an intake screen, a small pump and piping to discharge into a small potable Water Treatment Plant. Depending on the location of the Water Treatment Facilities at the site, the transmission distance for raw water would be approximately 50-100 feet. Even though there is only slight elevation changes between the POD and Water Treatment Plant the raw water will be pumped from the intake to the treatment plant. Figure 3.1.a is a schematic showing the location.

3.1.3 Raw Water Storage/Impoundment

There is an existing, albeit damaged, diversion dam in place at Henderson Creek. The diversion dam creates a "bulge" in the creek where water pools but is not blocked completely. The table below lists some basic characteristics and assumptions for the existing diversion dam at Henderson Creek.

Table 3.1.3 Diversion Dam Capacity

Diversion Dam Capacity	**22,400 Gal – 0.07 acre-ft.**
Water Depth	3 ft.
Outfall	Adjustable Weir

(a) assume 2:1 side slopes, concrete reinforced
(b) 1' Diversion Dam freeboard

Raw water storage/impoundment can be achieved on site at Henderson Creek. There are adequate amounts of water available for withdrawal from November to April. A raw water storage tank could also be utilized at the site to store water during the months of low flow.

3.1.4 Raw Water Treatment

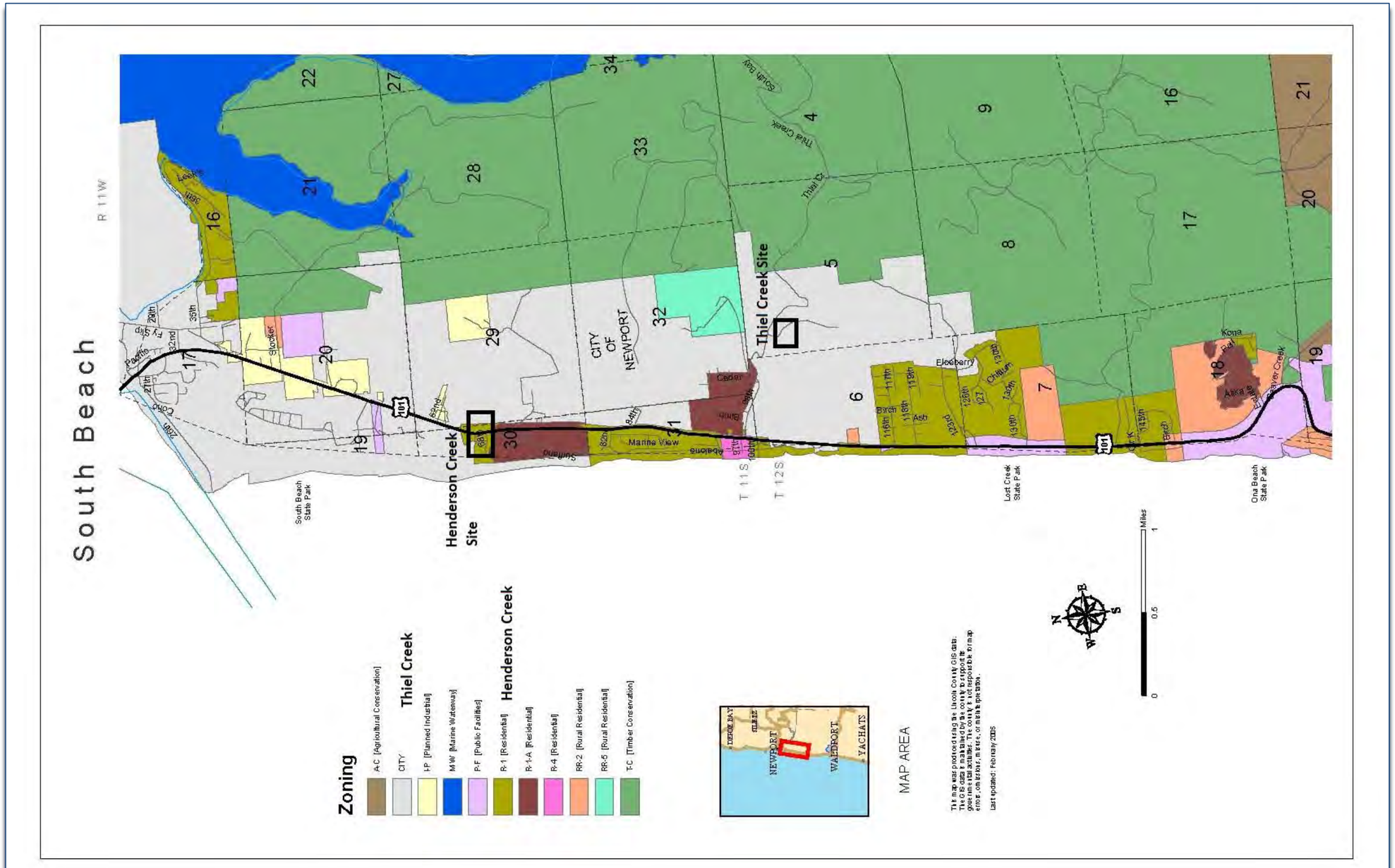
Site topography will affect the embankment layout and constructability at the site. Ideally, the site location would be at an elevation above the top of the existing structure and out of the flood zone of the creek. For the Henderson Creek location there would need to be a booster pump station to boost treated water into the existing distribution system. The size of the foot print of the treatment plant as shown on the schematic is a best guess and will vary depending on the manufacture and the quantity of flow treated.

For this location, the Treatment Plant capacity would be on the lower range of the treatment plant due to the available flows in the Creek. This treatment plant would require disposal of the sediments from the secondary treatment process and disposal of the backwash from the sand filter in the tertiary treatment process. In addition, the Henderson Creek location has a high potential of additional pollutants from the nearby highway runoff and the upstream sections, therefore these conditions would require a treatment plant that can provide greater removal of pollutants, which will need to be considered in the treatment plant and filtration design process.

3.1.5 Location of Facilities

As shown in Figure 3.1.a, the potential location of the treatment plant is immediately adjacent to the existing infrastructure with the ground elevation approximately 2 feet above the top of the existing in-water structures. There are some existing storage buildings that can be reused for storage of equipment. The site would need to be expanded to allow the movement of disposal vehicles for sludge and backwash collection at the treatment plant and improvements will be required for the 68th street access road out to Hwy 101. Access around the proposed treatment plant site may be difficult for large trucks and maneuverability within the site may require additional easements on the property. This area is zoned R-1, Residential.

Figure 3.1.5 South Beach Zoning – Henderson and Thiel Creeks



3.1.6 Backwash Facilities

See the description in Section 2.2. This portion will be the same for each water source from this point on and will depend on the treatment process and water quality of the source.

3.1.7 Distribution

Distribution refers to the transmission piping and booster pumps required to deliver the finished water from the potential treatment plant to the District's water system. The approximate length required to make this connection at the Henderson Creek Water Treatment Plant is 1,500 lineal feet from SW 68th street to SW 73rd street. Long lengths of pipeline and higher pressures between the treatment plant and the District's distribution system will have the tendency for more pipeline failures. Therefore, sites with the shortest length of raw water pipeline, and or sites with lower pressures between the site and the WTP are considered more desirable, such as Henderson Creek. This distribution system is one of the most straight-forward out of all the raw water locations because it would be possible to use the existing infrastructure and utility easements to connect to the nearby system.

3.1.8 Controls and Telemetry

Controls and telemetry will be monitored through SCADA (Supplementary Control and Data Acquisition) which will allow the District to receive warning signals about the functionality of the various facilities. The SCADA system can provide remote information and controls for the intake system, Water Treatment Facility, valves and booster pump. It is reasonable to assume that there could be a SCADA system installed at the Henderson Creek site and connected to the rest of the District system due to its proximity to the water distribution system and power supplies.

3.1.9 Power

This location, as with all of the locations that will require a Water Treatment Plant, will require three-phase power. This site will require three-phase power due to the pump and treatment plant power requirements. New power connections would require a new pole, new transformer and an underground conduit placed from the transformer to the Water Treatment Plant. The WTP would also require a backup, emergency power supply. This would most likely be in the form of a large diesel generator.

3.1.10 Property Issues

The suggested POD on Henderson Creek is located on a privately owned parcel of land; the parcel is approximately 1.5 acres in size and has access to SW 68th Street. This parcel is undeveloped land with the exception of the existing storage infrastructure and weir.

3.1.11 Environmental and Permitting Issues Associated with Infrastructure

Any work within a waterway will require a Joint Permit Application (JPA) submitted and coordinated by the Oregon Department of State Lands and the U.S. Army Corps of Engineers. Before the JPA is submitted, a wetland delineation should be performed and submitted to DSL. Depending on the location

of the treatment facility and the entire "project area" the wetland delineation will most likely evaluate the entire subject area. Possible mitigation efforts may be necessary depending on how much, if any, wetlands are impacted. Depending on the funding source a Biological Assessment may be required and perhaps an Environmental Report. Efforts should be taken to avoid impacts in sensitive wetland areas and waterways. The Henderson Creek location has a high likelihood to have wetlands onsite, although the wetlands may not be very large in size. This area is not in a designated estuary or significant conservation area.

3.1.12 Risk and Threat Analysis

Water treatment facilities should be located above the projected 100 year flood elevation to avoid plausible issues with flooding. According to FEMA's Flood Insurance Rate Maps and the Oregon HazVu in Figure 3.1.12, the proposed Henderson Creek site is not within of the 100 year flood plain or in a tsunami inundation area. Although Henderson Creek is not considered to be within the 100 year floodplain, there is still the possibility of damage to facilities due to earthquakes and landslides.

Compared to other raw water source sites, Henderson Creek has the highest amount of risk associated with manmade activities. The risk is due to the proximity and access from Hwy 101. Potential risk factors that could affect infrastructure and equipment would be primarily from vandalism. Manmade risks that pose a threat to water quality are truck spills and car accidents that may occur on Hwy 101. Additionally, the City of Newport currently uses an area at the Newport Municipal Airport to dispose of their effluent. The head waters of Henderson Creek begin above the airport and travel through and past the disposal area. This could impact the water quality at Henderson creek and require more water treatment processes.

Figure 3.1.12 Natural Hazards – Henderson Creek

3.2 Thiel Creek Introduction

Thiel Creek is a year-round stream and tidally influenced waterway. Hydrologic unit number 17100205 with a drainage area of 4.10 Sq. Miles. There are no existing in-water structures at this site with the exception of the access road and culvert for the creek. The location map on the following page shows the Point of Diversion adjacent to the access road and the potential treatment plant location next to the old barn.

Figure 3.2.a – Location Map

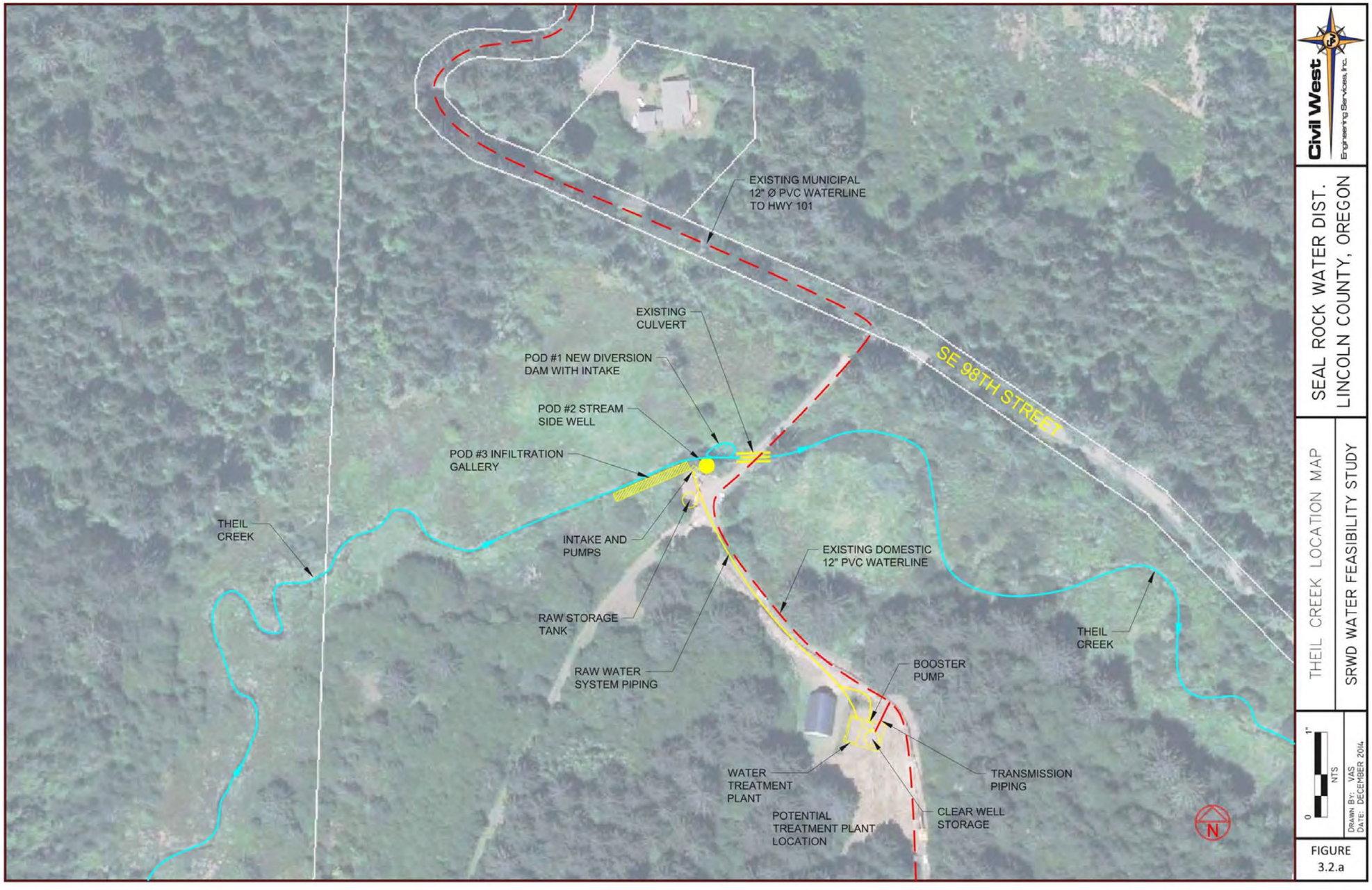


Figure 3.2.b - Site Photos

Thiel Creek

Culvert and Access Road

Culvert (Downstream View)

3.2.1 Raw Water Intake

Three possible intake alternatives or Point of Diversion (POD) exist for the Thiel Creek site, they are an instream intake structure, shallow stream side wells and an infiltration gallery. It is important to note that a combination of intake structures could be used to withdraw an optimal amount of water.

The shallow stream side wells and infiltration gallery alternatives depend on many factors including the permeability of the soils. The predominant soil type in the proposed area is a Brenner silt loam. According to the USDA, the Brenner Series are "Poorly drained; very slow runoff or ponded; slow permeability. The soil is frequently flooded for brief periods during the winter and is saturated with water for several months each year. The apparent high water table is at its highest level from December through April. The water ponds in winter are due to heavy rains or when streams overflow leaving thin layers of fresh alluvium on the surface."[3]

[3] National Cooperative Soil Survey, USDA. "Official Series Description- Brallier Series". Rev. GEO/JAS/RWL. 11/2004

In Stream Intake, POD #1:

The channel is shallow and would need to be widened and deepened, to create a diversion dam-like structure with an approximate volume of 25,000 cubic feet. The developed intake screen would need to have a self-cleaning feature to help remove leaves and debris from clogging the intake system. Low flows during the summer months could make an intake of this style inoperable.

Due to the possible presence of protected fish species in Thiel Creek, safe, timely and effective fish passage and screening must be implemented. The intake screen will need modifications, such as an end of pipe or pump intake screen to deter juvenile fish from being impacted by the intake suction.

Stream Side Wells, POD #2:

Another alternative to a subsurface intake is the use of a shallow streamside well. The number of wells necessary to supply the District should be decided by a hydrogeological study. A hydrogeological study would also help determine the level of the water table at the stream and whether the water table is consistent in the peripheral areas of the channel. Peripheral consistency is necessary for consistent water quality and water withdrawal. Similarly, a geological study would need to be conducted to establish whether geology supports permeability. It is necessary to understand the permeability of the soils and bed rock to determine the success of the wells. The slow permeability and poor drainage of the Brenner soil series may negatively impact the success of shallow stream side wells. Additionally, the number of wells needed is not known and could create significant variations in project costs, further evaluation would be necessary to determine if this would be a viable option.

Infiltration Gallery, POD #3:

The final alternative to a subsurface intake is an infiltration gallery. Infiltration galleries require similar hydrogeological and geologic conditions that are necessary for stream side wells. There are several locations adjacent to the Thiel Creek project area that would fit an infiltration gallery. It is also possible to use stream side wells or sump wells at the end of the infiltration gallery to collect the naturally filtered water. There may be issues with the permeability of soils as well as ponding and slow moving waters during the dry season.

3.2.2 Raw Water Transmission

Raw water transmission for Thiel Creek would be from the Point of Diversion (POD) or raw water storage tank to the treatment plant. Depending on the location of the Water Treatment Facilities at the site, the transmission distance for raw water would be approximately 380 feet. Even though there is only slight elevation changes between the POD and Water Treatment Plant the raw water will be pumped from the intake to the treatment plant. Figure3.2.a is a schematic showing the location of facilities.

3.2.3 Raw Water Storage/Impoundment

Raw water storage can provide the District with backup resources for the WTP as well as raw water storage to increase the reliability of the system. Certain site characteristics can limit the maximum storage potential, such as available in stream water. Raw water storage/impoundment depends on the

type of intake system installed. For instance, a raw water storage tank would be utilized at the site to store water if either the stream side wells or infiltration gallery option are used. If a submerged intake is constructed, the water restrained from the diversion dam would be adequate for most of the year for water storage and withdrawals. A schematic for an in water storage and an onsite raw water tank can be seen in Figure 3.2.a.

The table below lists some basic characteristics and assumptions for the suggested diversion dam.

Table 3.2.3 Diversion Dam Capacity

Diversion Dam Capacity	25,000 Gal – 0.08 acre-ft.
Water Depth	4 ft.
Outfall	Adjustable Weir

(a) assume 2:1 side slopes, compacted earth
(b) 1' Diversion Dam freeboard

3.2.4 Raw Water Treatment

Site topography will affect the embankment layout and constructability at the site. Ideally, the Water Treatment Plant location would be at an elevation above the top of the intake and raw water storage while being out of the flood zone of the creek. The size of the foot print of the treatment plant as shown on the schematic is a best guess and will vary depending on the manufacture and the quantity of flow treated.

For this location, the WTP capacity would be in the mid-range for the treatment plant due to the seasonal fluctuating flows in the Creek. This treatment plant would require disposal of the sediments from the secondary treatment process and disposal of the backwash from the sand filter in the tertiary treatment process. See Section 2.2- Backwash Facilities.

3.2.5 Location of Facilities

As shown in Figure 3.2.a., the prospective location for the treatment plant is east and immediately adjacent to the existing barn and is approximately 20 feet higher than the creek at the access road crossing. The site would need to be expanded to allow the movement of disposal vehicles for sludge and backwash collection at the treatment plant and improvements will be required for the access road to SE 98th street. The placement of the intake system depends on the type of intake but would most likely be located near the existing culvert. If an infiltration gallery is selected it could be placed on either side of Thiel Creek, depending on what prospective location would support the system best. The raw water storage tank and pump station should be placed near the WTP to avoid having infrastructure in the flood plain. For the zoning see Table 3.1.5 in the previous section.

3.2.6 Backwash Facilities

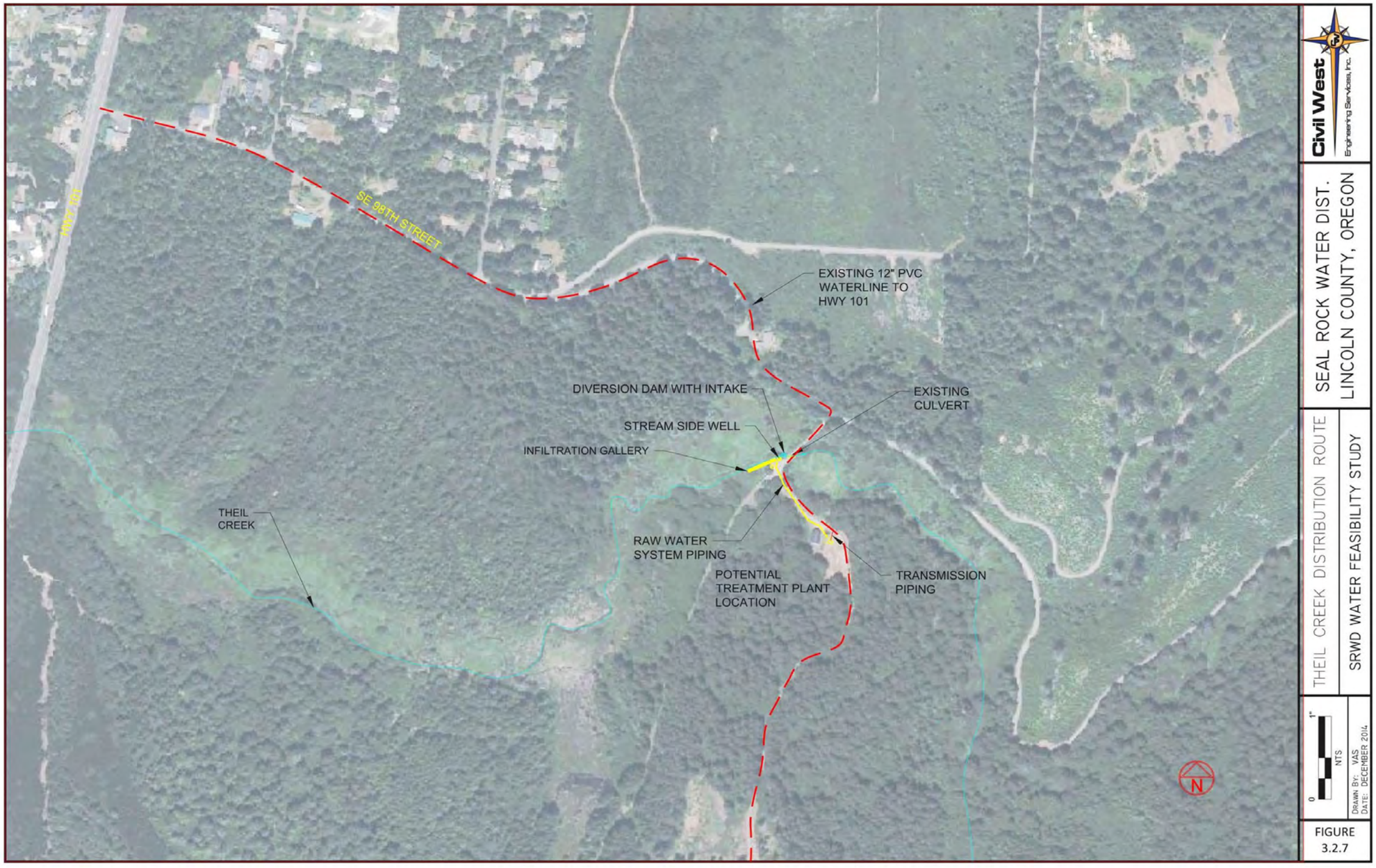
See the description in Section 2.2. This portion is the same for each water source at this point and will

depend on the treatment process and water quality of the source.

3.2.7 Distribution

Distribution refers to the transmission piping and booster pumps required to deliver the finished water from the potential treatment plant to the District's water system. The approximate length required to make this connection for the Theil Creek Water Treatment Plant is 50 lineal feet from the treatment plant to the existing 12" water line located in the access road. This site has a short connection length with the distribution system. This distribution system is one of the more straight-forward out of the raw water locations because of the close proximity of the point of diversion, treatment plant location, and existing municipal water system piping. For the Theil Creek location there would need to be a booster pump station to lift treated water into the existing distribution system.

Figure 3.2.7-Water Distribution Route



3.2.8 Controls and Telemetry

Controls and telemetry will be monitored through SCADA (Supplementary Control and Data Acquisition) which will allow the District to receive warning signals about the functionality of the various facilities. The SCADA system can provide remote information and controls for the intake system, Water Treatment Facility, valves and booster pump. It is reasonable to assume that there could be a SCADA system installed at the Thiel Creek site and connected to the rest of the District system due it its proximity to the water distribution system.

3.2.9 Power

This location, as with all of the locations that require a Water Treatment Plant, will require three-phase power. This site will involve three-phase power due to the pump and treatment plant power requirements. New power connections would require a new pole, new transformer and an underground conduit placed from the transformer to the Water Treatment Plant. Connection to the nearest power is approximately 3,000 feet away at the intersection of SE 98th Street and SE Cedar Street. The WTP would also require a backup, emergency power supply. This would most likely be in the form of a large diesel generator.

3.2.10 Property Issues

The proposed POD on Thiel Creek is located on a privately owned parcel of land. The over 100 acre property has a lot zoned for Residential and the remaining acreage is designated US Forest Land. There may be a need to have an easement secured for the access road and water transmission lines from the creek intake to the Water Treatment Plant. There is the potential to acquire the land as well.

3.2.11 Environmental and Permitting Issues Associated with Infrastructure

Any work within a waterway will require a Joint Permit Application (JPA) submitted and coordinated by the Oregon Department of State Lands (DSL) and the U.S. Army Corps of Engineers. Before the JPA is submitted, a wetland delineation should be performed and submitted to DSL. The suggested location for the WTP at Thiel Creek appears to be upland, but the intake and other infrastructure may be in a waterway or wetland area. The infiltration galleries, if selected, will require significant amount of trenching and work within wetland areas. Possible mitigation efforts may be necessary depending on the amount of wetlands that are impacted. Depending on the funding source a Biological Assessment will most likely be required and perhaps an Environmental Report. Efforts should be taken to avoid impacts in sensitive wetland areas and waterways. The presence of protected fish is recorded for Thiel Creek and protecting their habitat will most likely be a necessary component to developing the area. This area is not in a designated estuary or significant conservation area.

3.2.12 Risk and Threat Analysis

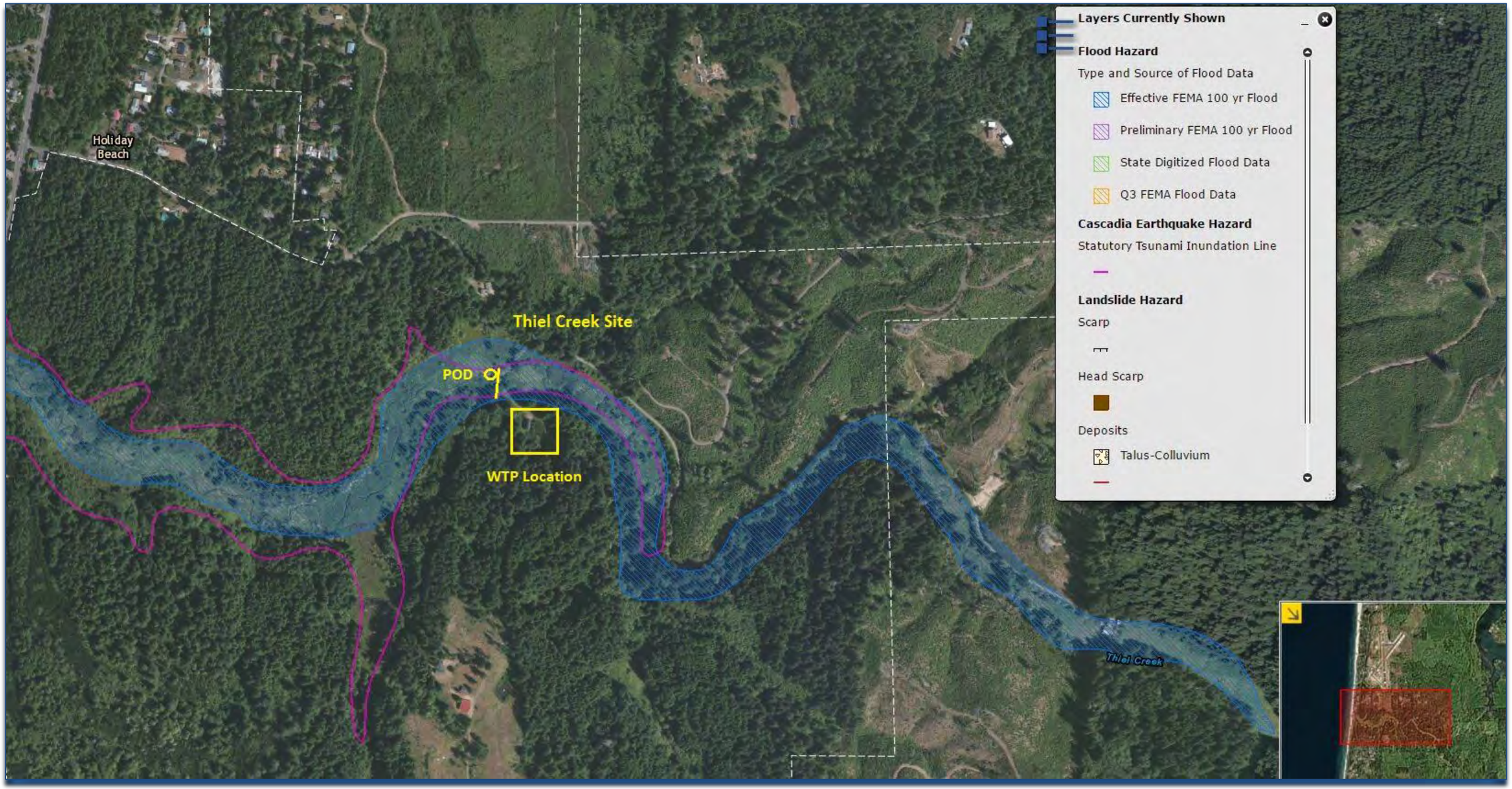
Water treatment facilities should be located above the projected 100 year flood elevation to avoid

plausible issues with flooding. According to FEMA's Flood Insurance Rate Maps and Oregon HazVu, the projected Thiel Creek POD location is within the 100 year flood plain and tsunami inundation area. However, the recommended WTP location is not within the flood plain or tsunami area.

Facilities at Theil Creek have a low amount of risk of manmade threats. The area is isolated which deters vandals and there is not significant development upstream from the POD. There is, however, probable timber activities that may occur upstream from the POD. These activities, along with other agricultural activities could negatively affect the quality of water and require higher levels of water treatment.

The majority of Thiel Creek lowlands are considered to be within a floodplain. This increases the risk linked with annual flooding as well as flooding and debris damage associated with tsunamis. However, there are areas near the Creek that offer high elevations.

Figure 3.2.12 Natural Hazards – Thiel Creek



3.3 Beaver Creek Introduction

North Beaver Creek Road leads from Highway 101 in Seal Rock, east past Beaver Creek State Natural Area and into the green hills and forests that Oregon is known for. Beaver Creek has a drainage area of 21.40 miles and a Hydrologic Unit of 17100205. The Brian Booth State Park is within the Beaver Creek State Natural Area. This area provides essential habitat for fish and wildlife and is also widely used as a recreation space for visitors. The project area is approximately 1.5 miles southeast of Hwy 101 and North Beaver Creek Road where South Beaver Creek Road crosses over Beaver Creek. The estimated river mile at this point is 2.05. The water at this point may be brackish and may have higher levels of salinity than at other raw water sources, sampling would confirm if there are significant and constraining periods where the point of withdrawal is brackish.

Figure 3.3.a – Location Map

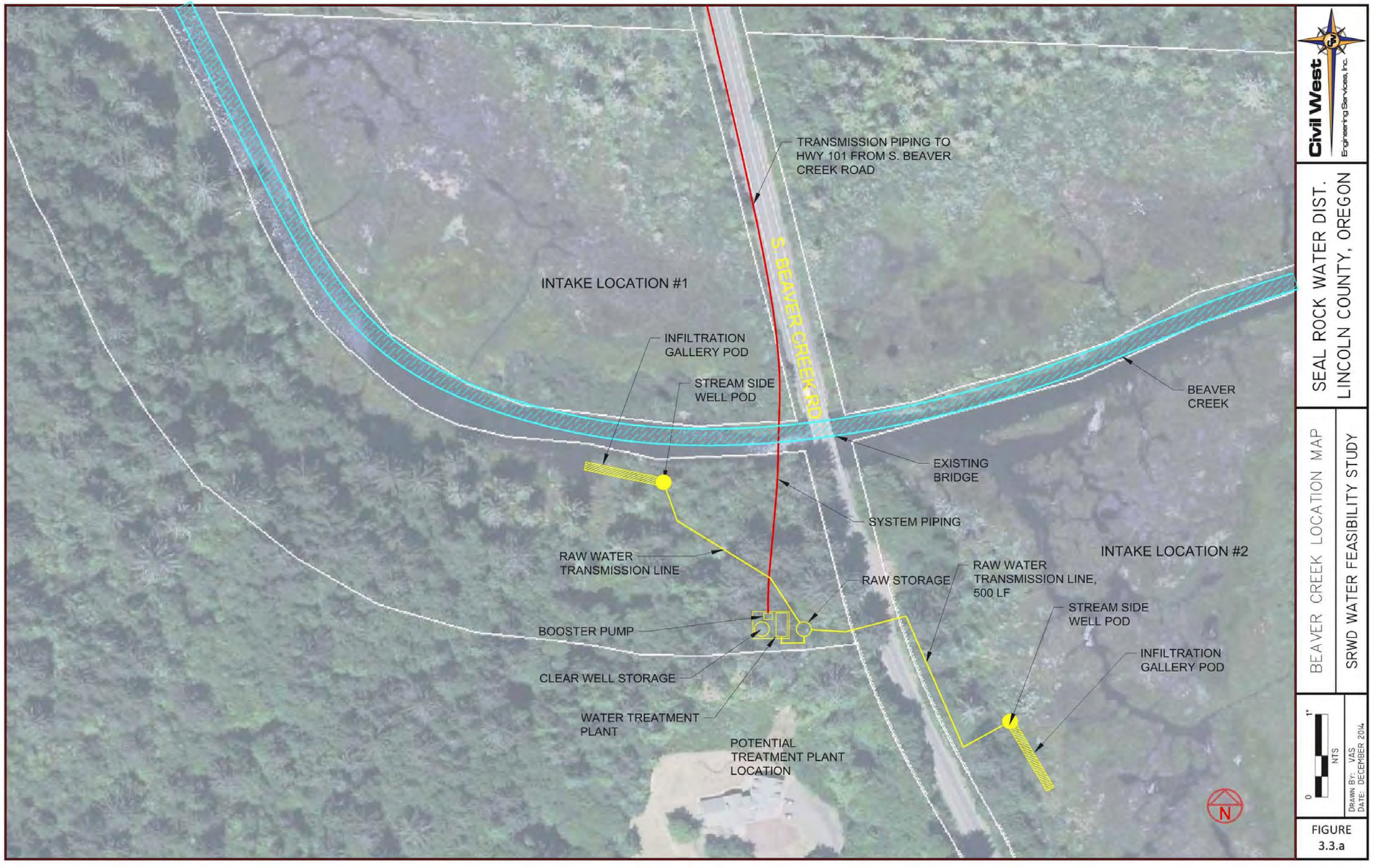
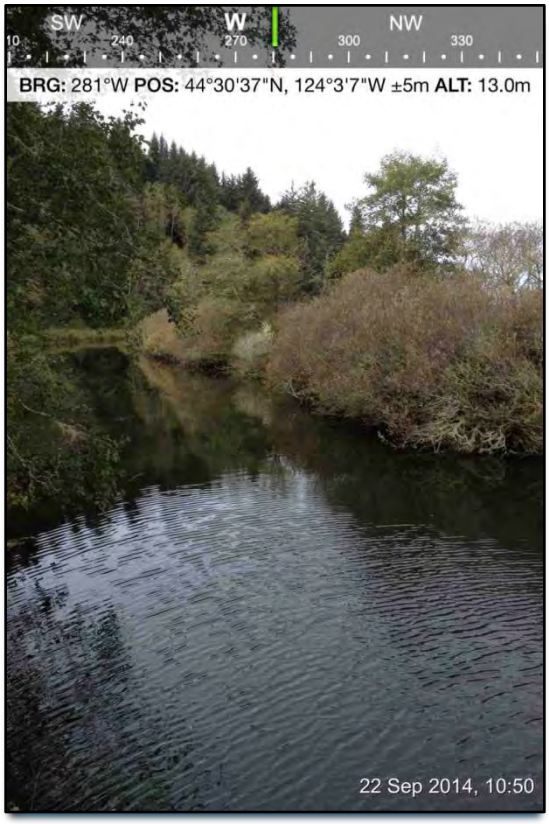


Figure 3.3.b - Site Photos

Beaver Creek



Downstream View from S. Beaver Creek Rd.

South Bank (WTP Site)

3.3.1 Raw Water Intake

Two possible intake alternatives exist for the Beaver Creek site; option #1 shallow stream side wells and/or option #2 an infiltration gallery. Both of these alternatives depend on many factors including the permeability of the soils. The predominant soil type in the proposed area is a Brallier mucky peat. According to the USDA, the Braillier soil series are considered "Very poorly drained; moderate permeability. The soils are affected by the tide and have a fluctuating water table. It is frequently flooded for brief periods from November to April and has a high water table from 1 foot above to 2 feet below from January to December."[4]

Stream Side Wells:

Stream side wells are constructed close to the stream bank and can take advantage of infiltrated water that is percolated through soils from the water body. The well does not need to be as deep as wells reaching to the water table. The collected water is pumped from the shallow well caisson to the Water Treatment Plant. The number of wells necessary to supply the District should be decided by a

[4] National Cooperative Soil Survey, USDA. "Official Series Description- Brallier Series". Rev. JAS/AON/RWL. 12/1999

hydrogeological study. A hydrogeological study would also help determine the level of the water table at the stream and whether the water table is consistent in the peripheral areas of the channel. The depth of the well depends on the water table at the site. Additionally, a geological study would need to be conducted to establish whether geology supports permeability. The Braillier soil series found in this area are moderately permeable. The number of wells needed is not known and could create significant variations in project costs, further evaluation is necessary.

Infiltration Gallery:

The final alternative to a subsurface intake is an infiltration gallery. Infiltration galleries require similar hydrogeological and geologic conditions that are necessary for stream side wells. It is also possible to use a stream side well or sump well at the end of the infiltration gallery to collect the naturally filtered water. The moderate permeability of the soils at the Beaver Creek site, along with the year round flows of Beaver Creek suggest that infiltration galleries may be a viable option for a water source although more in depth studies should be conducted (as noted above).

Two potential intake locations with a combination of stream side wells and/or infiltration galleries exist for the Beaver Creek site. See Figure 3.3.a

Location 1: Located directly adjacent to Beaver Creek and closest to the suggested location for the Water Treatment Plant.

Location 2: Located southeast and across South Beaver Creek Road from the suggested Water Treatment Plant location.

3.3.2 Raw Water Transmission

Raw water transmission for this site would be from the Point of Diversion to the raw water storage tank at the Water Treatment Plant. Raw water transmission would require an infiltrated storage well, a small pump and piping to discharge into a small potable Water Treatment Plant. As shown in Figure 3.3.a, possible raw water transmission piping corridors are dependent upon the location of the various project components such as the location of the Water Treatment Plant and the location of the wells and/or the infiltration galleries. The transmission piping distance can be between 100 to 600 lineal feet depending on which location is chosen for the intake(s).

3.3.3 Raw Water Storage/Impoundment

Raw water storage/impoundment can be achieved on site at Beaver Creek via a raw water storage tank. Having an adequate raw water storage tank on site would help with the overall resiliency of the District's water system and provide flows to the WTP in case of shortages. There are adequate amounts of water available for withdrawal year round that can be withdrawn from an infiltration gallery and/or shallow stream side wells and pumped to a storage tank.

3.3.4 Raw Water Treatment

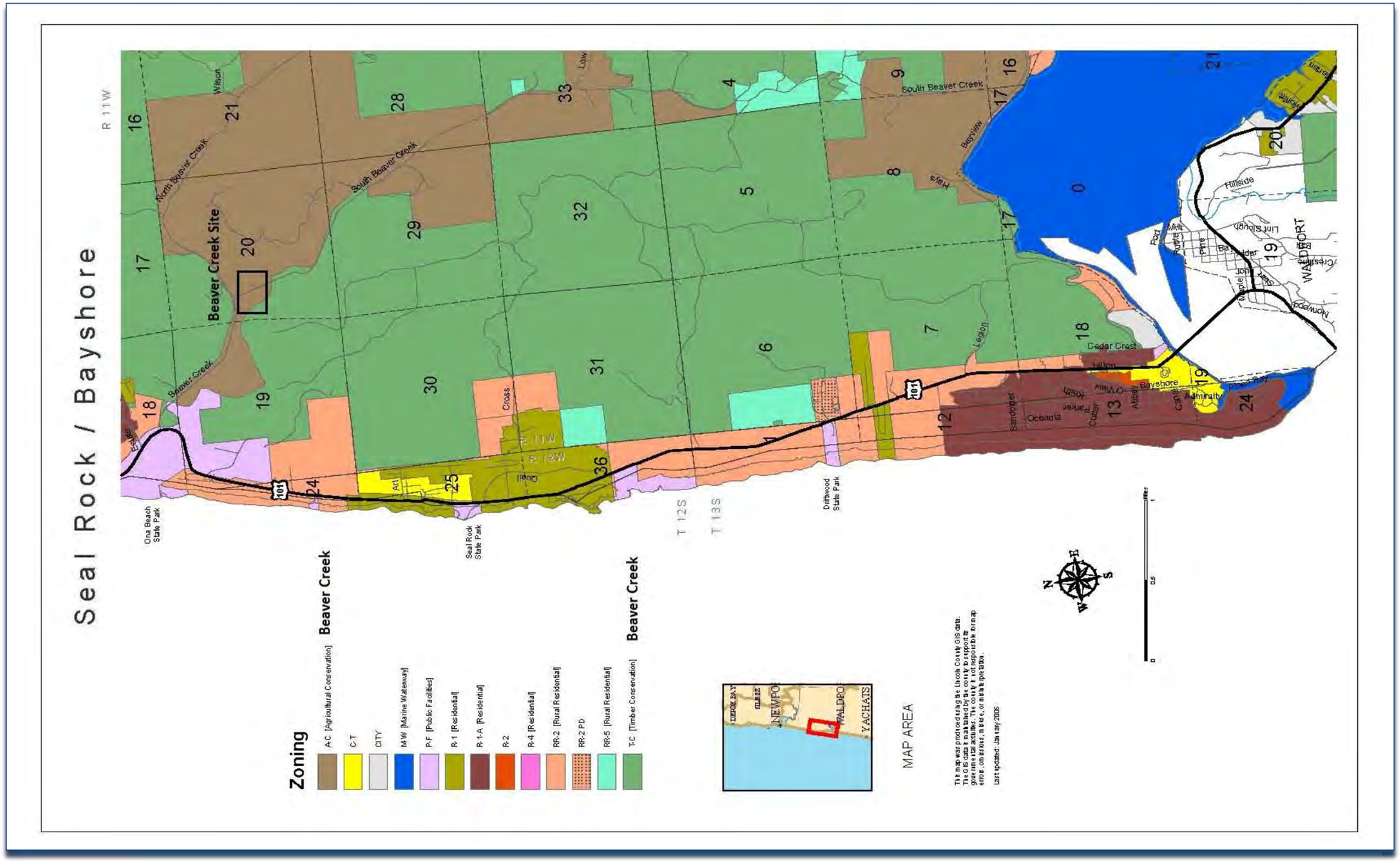
The proposed WTP site is located on top of a ridge adjacent to Beaver Creek, up a steep hillside. The site location as shown in Figure 3.3.a is not within the flood zone. This location would need a booster pump station to lift treated water into the existing distribution system. The size of the foot print of the treatment plant as shown on the schematic is a best guess and will vary depending on the manufacture and the quantity of flow treated.

The treatment plant capacity for Beaver Creek would depend on the amount of available water that can be withdrawn throughout the year. This site would be expected to have more water available than some of the other smaller creeks analyzed. The water at this site may have higher salinity levels than some of the other water sources and therefore may require varied levels of water treatment. If testing results in water with high salinity during infrequent periods, brackish water existence can be accommodated by use of a conductivity measurement in the WTP feed to shut-down the plant feed for a variable period of time subsequently determined to allow the brackish water to exit the stretch of the creek from which the withdrawal is being made.

3.3.5 Location of Facilities

As shown in Figure 3.3.a, the possible location of the treatment plant is adjacent to Beaver Creek on top of a nearby ridge, with an elevation of approximately 60 feet. The site would need to be expanded to allow the movement of disposal vehicles for sludge and backwash collection at the treatment plant. Improvements will be required for the access out to South Beaver Creek Road. Access around the proposed treatment plant site may be difficult for large trucks and maneuverability within the site may require additional easements on the property. Depending on the exact location of facilities the zoning is either TC-Timber Conservation or AC- Agricultural Conservation.

Figure 3.3.5 Zoning – Seal Rock Bayshore



3.3.6 Backwash Facilities

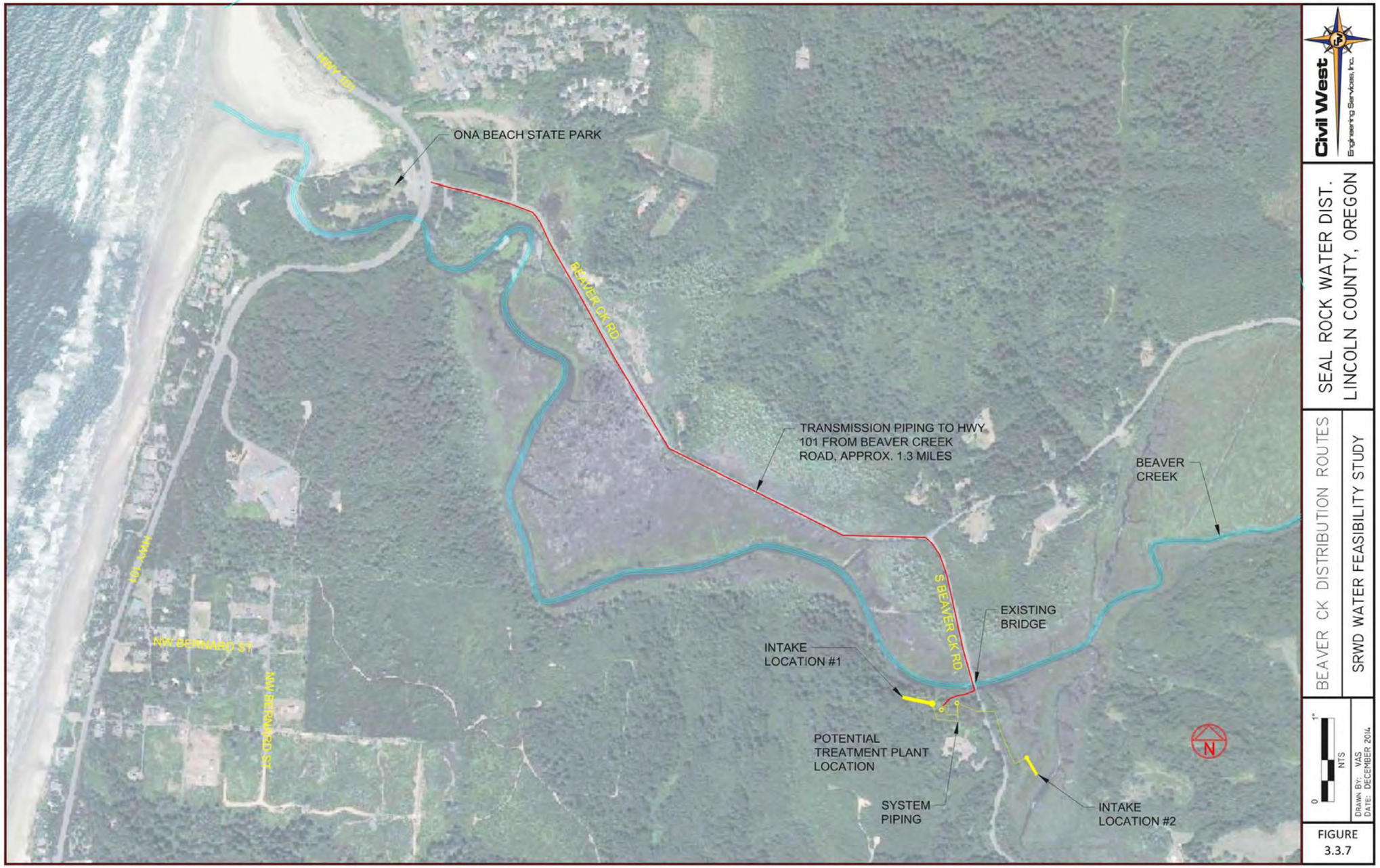
See the description in Section 2.2. This portion is the same for each water source at this point and will depend on the treatment process and water quality of the source.

3.3.7 Distribution

Distribution refers to the transmission piping and booster pumps required to deliver the treated water from the proposed treatment plant to the District's water system. The most feasible option for the Beaver Creek Water Treatment Plant is illustrated in Figure 3.3.7. This location will require a booster/pump station to lift the water into the pressure zone for distribution in these areas.

The ideal transmission option would be to make the distribution connection from the Water Treatment Plant along South Beaver Creek Road to North Beaver Creek Road and make the final connection to the existing system at Hwy 101. A majority of the piping will be along the existing road shoulder with a section of piping to be placed using Horizontal Directional Drilling (HDD) under Beaver Creek near the bridge on South Beaver Creek Road. The approximate total length required for transmission to the distribution system is 7,000 lineal feet or 1.3 miles.

Figure 3.3.7- Water Distribution Route



3.3.8 Controls and Telemetry

Controls and telemetry will be monitored through SCADA (Supplementary Control and Data Acquisition), this provides remote information and controls for the intake system(s), Water Treatment Facility, valves and booster pump. It is possible to install a SCADA system at the Beaver Creek site and connect to the rest of the District system although it is semi-remote and radio connectivity would have to be ensured.

3.3.9 Power

This location, as with all of the locations that will require a Water Treatment Plant, will require three-phase power. This site will require three-phase power to be hooked up to it due to the pumps and treatment plant power requirements. New power connections would require a new pole, new transformer and an underground conduit placed from the transformer to the Water Treatment Plant. The WTP would also require a backup, emergency power supply. This would most likely be in the form of a large diesel generator.

3.3.10 Property Issues

The property surrounding the proposed Point of Diversion and Water Treatment Plant sites are primarily private property. This area is very near the Beaver Creek Natural Area and is visited year-round by numerous interest groups. The suggested transmission route for treated water is mostly in the road-right-of-way, except where the water line would cross under Beaver Creek. Property acquisition and/or access and use easements would need to be secured to use this location.

3.3.11 Environmental and Permitting Issues Associated with Infrastructure

Potential permitting, regulatory and environmental hurdles associated with development of the site may include fill/removal permitting, wetlands, cultural, and other issues that could impact the viability and cost of development for a specific alternative. Depending on the funding source a Biological Assessment will most likely be required and perhaps an Environmental Report.

Any work within a waterway will require a Joint Permit Application (JPA) submitted and coordinated by the Oregon Department of State Lands and the U.S. Army Corps of Engineers. Before the JPA is submitted, a wetland delineation should be performed and submitted to DSL. Depending on the location of the treatment facility and the entire “project area” a wetland delineation will most likely evaluate the entire subject area. Possible mitigation efforts may be necessary depending on how much, if any, wetlands or waters are impacted. If mitigation appears to be necessary, early coordination with local organizations such as the Mid-Coast Watersheds Council should be developed as early as possible.

Beaver Creek is a protected natural area and has several conservation, restoration plans, and conservation easements in place. The Beaver Creek Basin is valued for its recreational and natural resources. There are multiple protected fish species that have a presence in the creek, for this reason in stream intake structures and water withdrawals are not considered for this project. Any work done in or around Beaver Creek will be sensitive, and involving all impacted stakeholders will be essential.

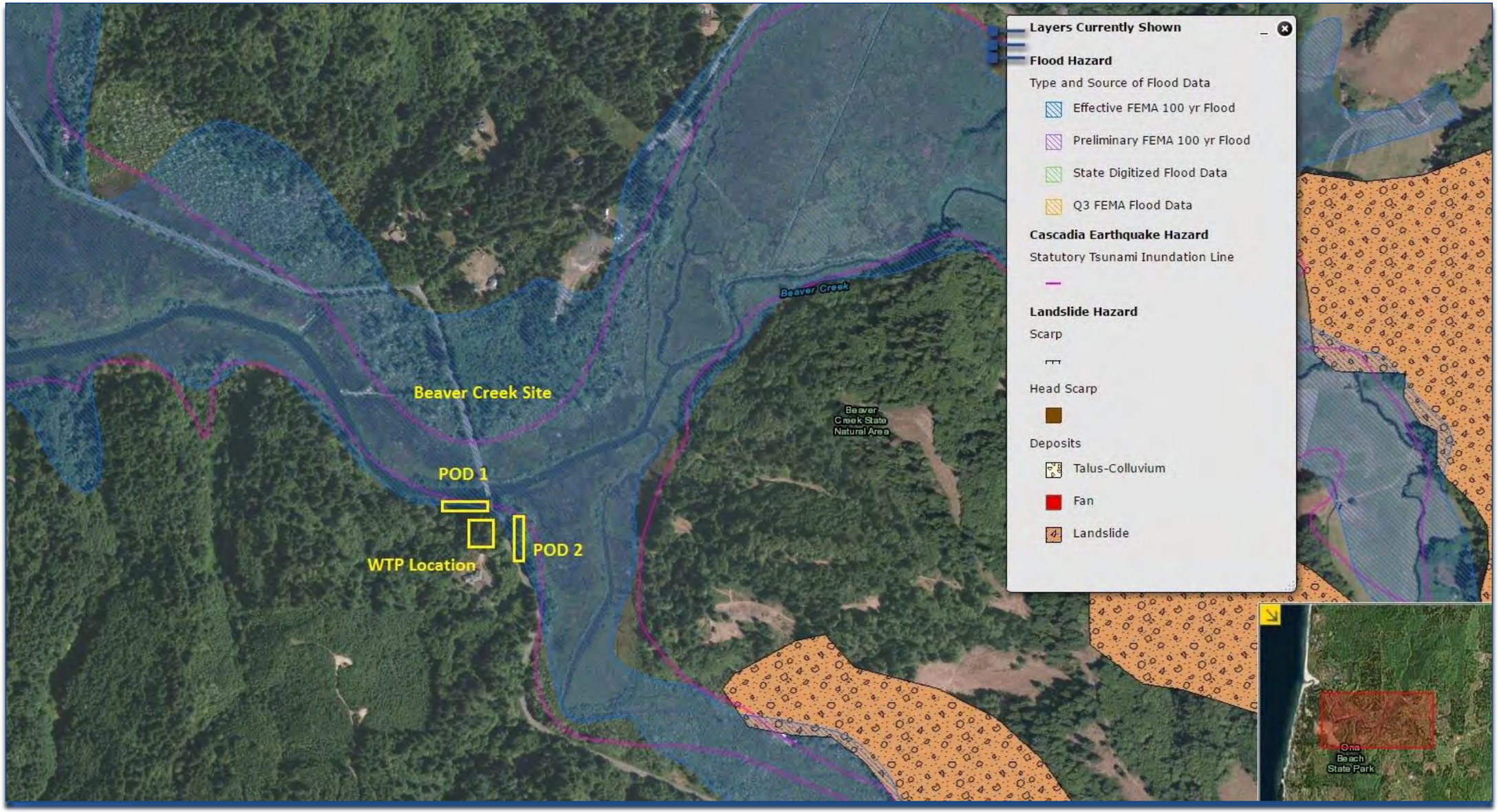
3.3.12 Risk and Threat Analysis

Water treatment facilities should be located above the projected 100 year flood elevation to avoid plausible issues with flooding. According to FEMA's Flood Insurance Rate Maps and Oregon HazVu, the proposed location for the Water Treatment Facility, is outside of the flood zone and tsunami inundation zone. The intake structures are within these areas though. Modifications to the intake structures (stream side wells and infiltration galleries) could be accomplished to minimize impacts from flooding and tsunamis.

Facilities at Beaver Creek have a moderate amount of risk of manmade threats. This location is near a busy road that is primarily used by local residents but does get increased amount of traffic during the summer season. There can be fencing installed to protect facilities but there is always the threat of vandalism to equipment in rural areas. There are also probable timber activities that may occur upstream from the POD. These activities, along with other agricultural activities could negatively affect the quality of water and require higher levels of water treatment. Further water quality tests should be conducted.

The majority of Beaver Creek is considered to be within a floodplain. This increases the risk linked with annual flooding as well as flooding and debris damage associated with tsunamis. However, the WTP location is not within the floodplain or tsunami areas.

Figure 3.3.12 Natural Hazards – Beaver Creek



3.4 Drift Creek Introduction

Two sites were visited as possible raw water sources at Drift Creek for the District. Site 1 is south of the Drift Creek Gage 14306600, it is located on a small patch of Siuslaw National Forest Land between private property parcels. The access is via a County maintained road. The second site, Drift Creek Site 2, is located below Wheelock Creek/Falls, closer to the mouth of Drift Creek. This site is owned by the USFS and is accessed via the same County maintained road as well as gravel/dirt Forest Service roads. Drift Creek and both of these stream locations are considered a tidally influenced waterway. The second site is within an area that the US Forest Service has been restoring into natural marshland habitat. The water at this point may be brackish and may have higher levels of salinity than at other raw water sources, sampling would confirm if there are significant and constraining periods where the point of withdrawal is brackish.

Due to the lack of space for facilities and the remote location of Site 1, it will not receive a complete analysis in this section. Site 1 would potentially only be used for a POD site, but would add approximately 1.5 million dollars to the project; consequently it is referred to but left out in the final cost analysis.

Figure 3.4.a – Location Map – Drift Creek Site 1 and Site 2

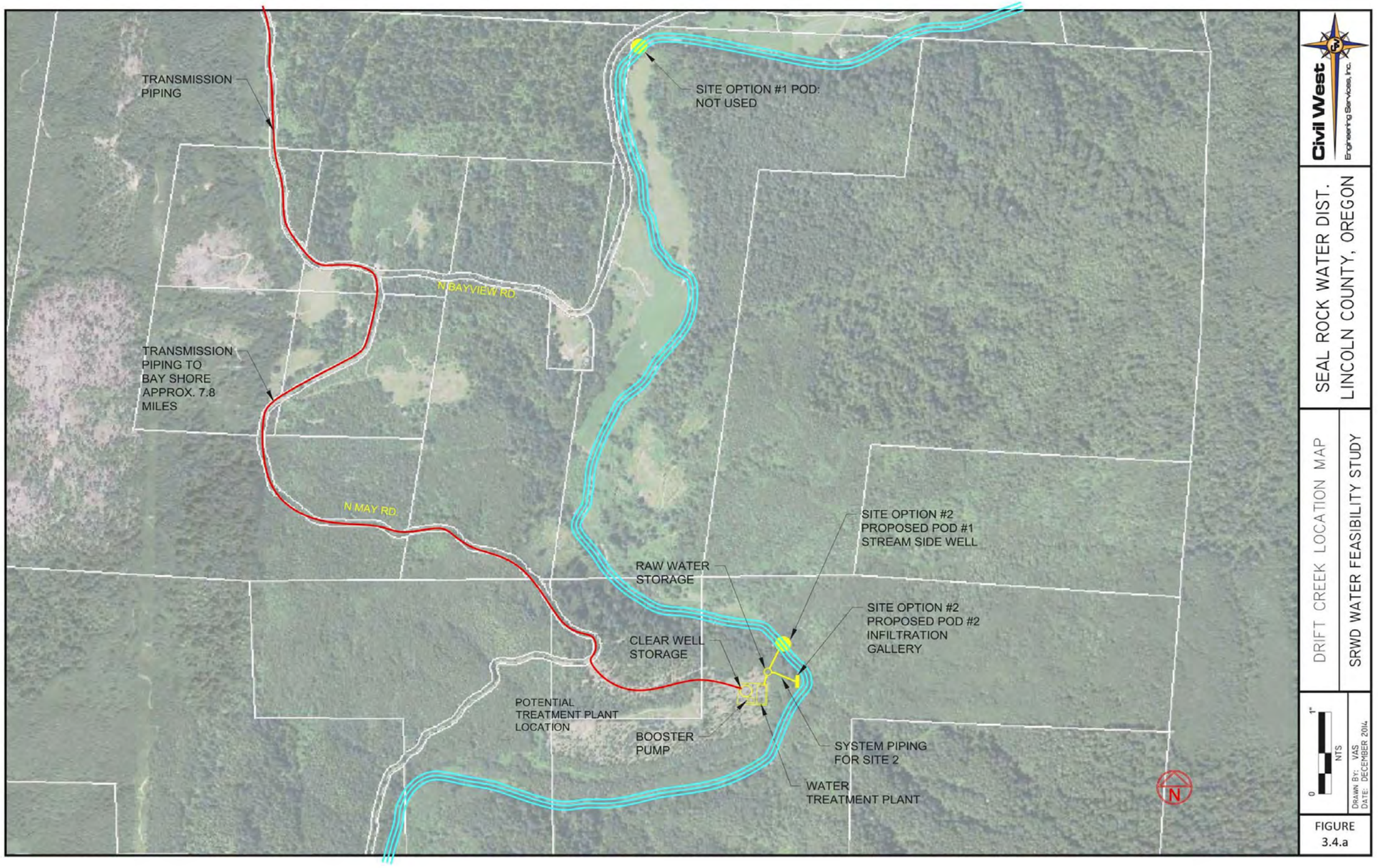


Figure 3.4.b – Location Map – Drift Creek Site 2

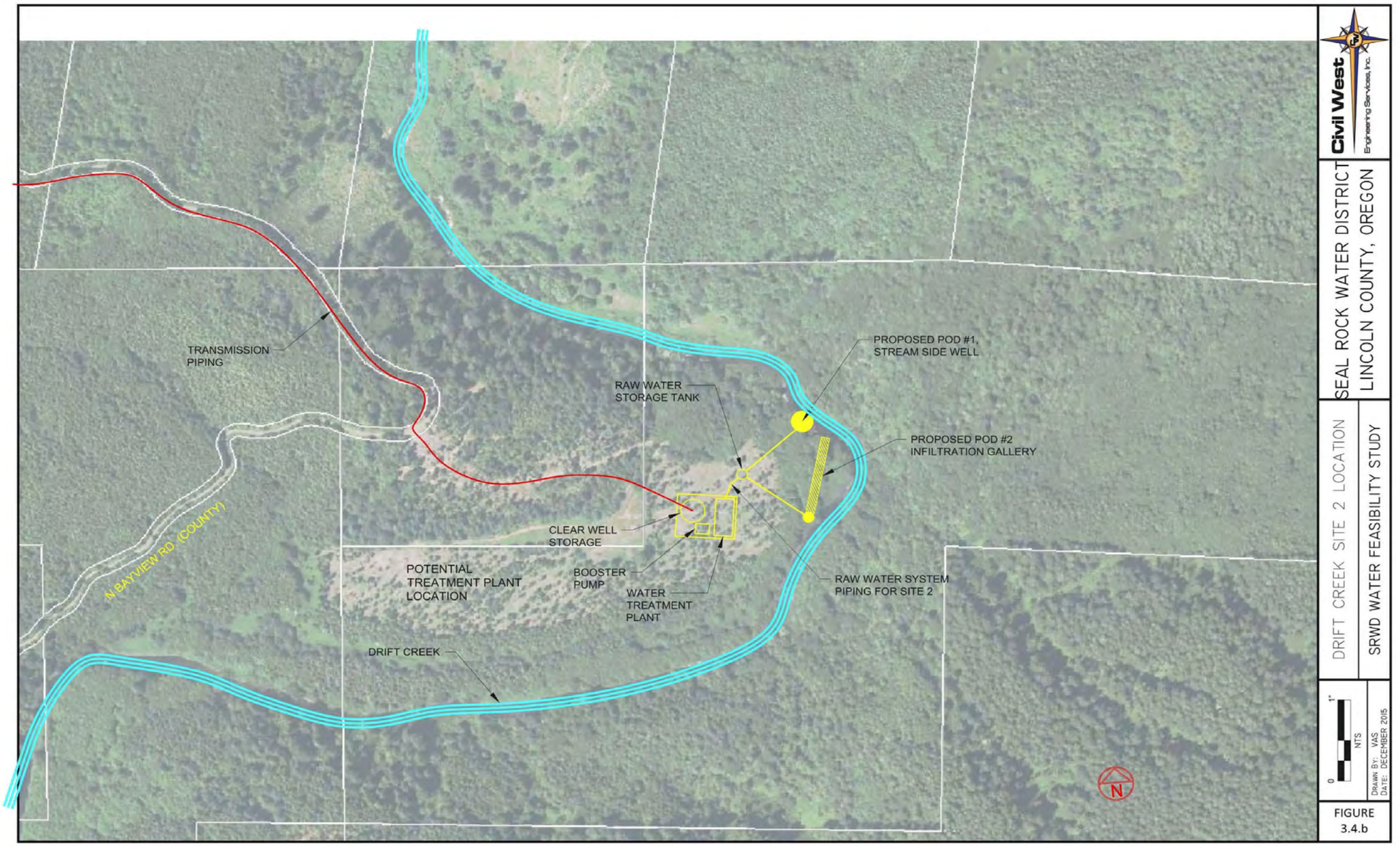


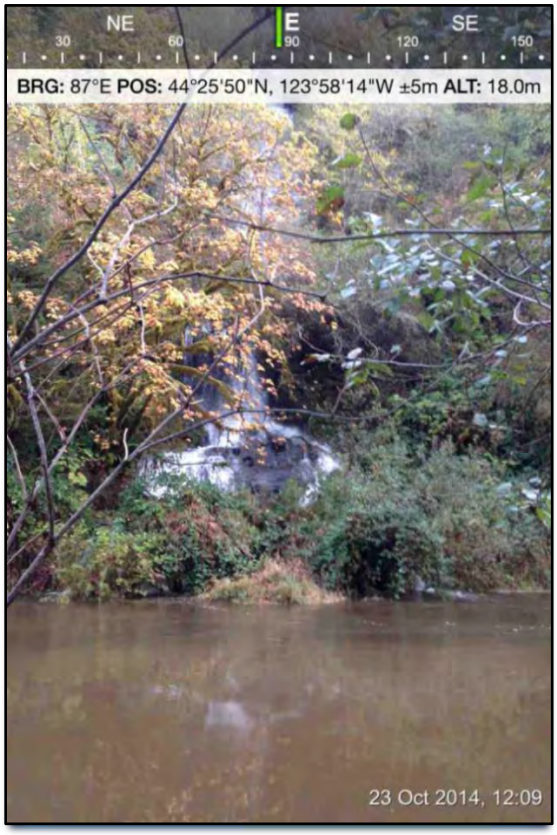
Figure 3.4.c – Site Photos – Drift Creek Site 1

Drift Creek – Site 1

Drift Creek Site 1 (Looking Up River)

Drift Creek Site 1 (Looking across Drift Cr.)

Drift Creek Site 2



Site 2 (Looking SE across Drift Cr.)

Site 2 (Potential Location for the WTP)

3.4.1 Raw Water Intake

Two possible intake alternatives exist for the Drift Creek Site 2; shallow stream side wells or an infiltration gallery. An instream/submerged intake system was not evaluated for these locations due to the assumed difficulty in permitting and access. For either of these intake types, it is recommended that there be a raw water storage tank to hold the water as it is removed. Stream side wells and infiltration galleries depend highly on the permeability of the soils. Preliminary soil permeability for each location is described below.

<u>Site 2 – Within USFS Boundary:</u>

The predominant soil types in the projected project site 2 are Knappa Silt Loam and Nehalem silt loam. The description of the Knappa soil series is in the preceding section for Site 1. According to the USDA, the Nehalem soil series are well drained with moderate permeability. Nehalem soils are subject to frequent or occasional flooding for brief periods. The particle-size control section has 18 to 35 percent clay and less than 15 percent coarser than very fine sand.[5]

[5] National Cooperative Soil Survey, USDA. "Official Series Description- Knappa Series". Rev. JAS/AON/RWL. 06/2011

Stream Side Wells:

Stream side wells are more shallow than conventional wells and don't require depths that reach the water table. Water is naturally filtered and many impurities are removed by percolation through the soils. At Drift Creek Site 1, stream side wells may not be a feasible option due to the steep banks of the river and the lack of peripheral area. If stream side wells could be constructed, water would be pumped from the wells to the Water Treatment Plant at the Drift Creek Site 2. The soils in this area are well drained and have moderate permeability, indicating that wells may be a viable option.

Stream side wells could work well at the Drift Creek Site 2. There are level areas near the waterway that have topography conducive to shallow wells. The soils in this area are well drained and have moderate permeability, indicating that wells could be a worthwhile option. If permeability allowed wells to work there is space for several wells.

The number of wells necessary to supply the District should be decided by a hydrogeological study. A hydrogeological study would also help determine the level of the water table at the stream and whether the water table is consistent in the peripheral areas of the channel. Similarly, a geological study would need to be conducted to establish whether geology supports permeability. The number of wells needed is not known and could create significant variations in project costs; therefore, further evaluation is necessary.

Infiltration Gallery:

The Drift Creek Site 1 may not be an appropriate location for an infiltration gallery due to the steep embankments and lack of space. There is however, adequate space near the Drift Creek Site 2 that would function well for an infiltration galley. The soils at this location would be conducive to infiltration galleries due to how they drain and their permeability. The waters at this location, just below Wheelock Creek are tidally influenced and may have high salinity levels. This would impact the type of water treatment processes and backwash facilities.

3.4.2 Raw Water Transmission

Raw water transmission would require an infiltrated storage well, small pump and piping. As shown on Figure 3.4.a, viable raw water transmission piping corridors are dependent upon the location of the various project components such as the location of the Water Treatment Plant, the raw water storage tank, stream side wells and the infiltration gallery.

Raw water transmission for Site 1 would be from the Point of Diversion (Stream side wells and/or infiltration galleries) to the Water Treatment Plant at Site 2. Longer lengths of raw water pipeline between the raw water storage site and the WTP could create more locations for outages and more pipelines to potentially fail. In addition, higher pressures in the pipeline could increase the chances of failure. As mentioned in the introduction, this raw water transmission piping adds disproportionate costs to this site so it was removed as an option.

The raw water transmission piping distance for Site 2 is approximately 950 feet as shown on the Figure 3.4.b. The raw water would be pumped from the intake system to the raw water storage tank.

3.4.3 Raw Water Storage/Impoundment

Raw water storage/impoundment may be difficult to achieve at Drift Creek Site 1 due to the topography and lack of space. There is the possibility that a raw water tank could be constructed on site, and then pumped to the WTP at Drift Creek Site 2. A raw water storage tank would be necessary to store water during the months of low flow in the river for either site. There is adequate space to house a raw water storage tank at the Drift Creek Site 2. It would be located near the WTP and would only have to be pumped a short distance from the intake systems.

3.4.4 Raw Water Treatment

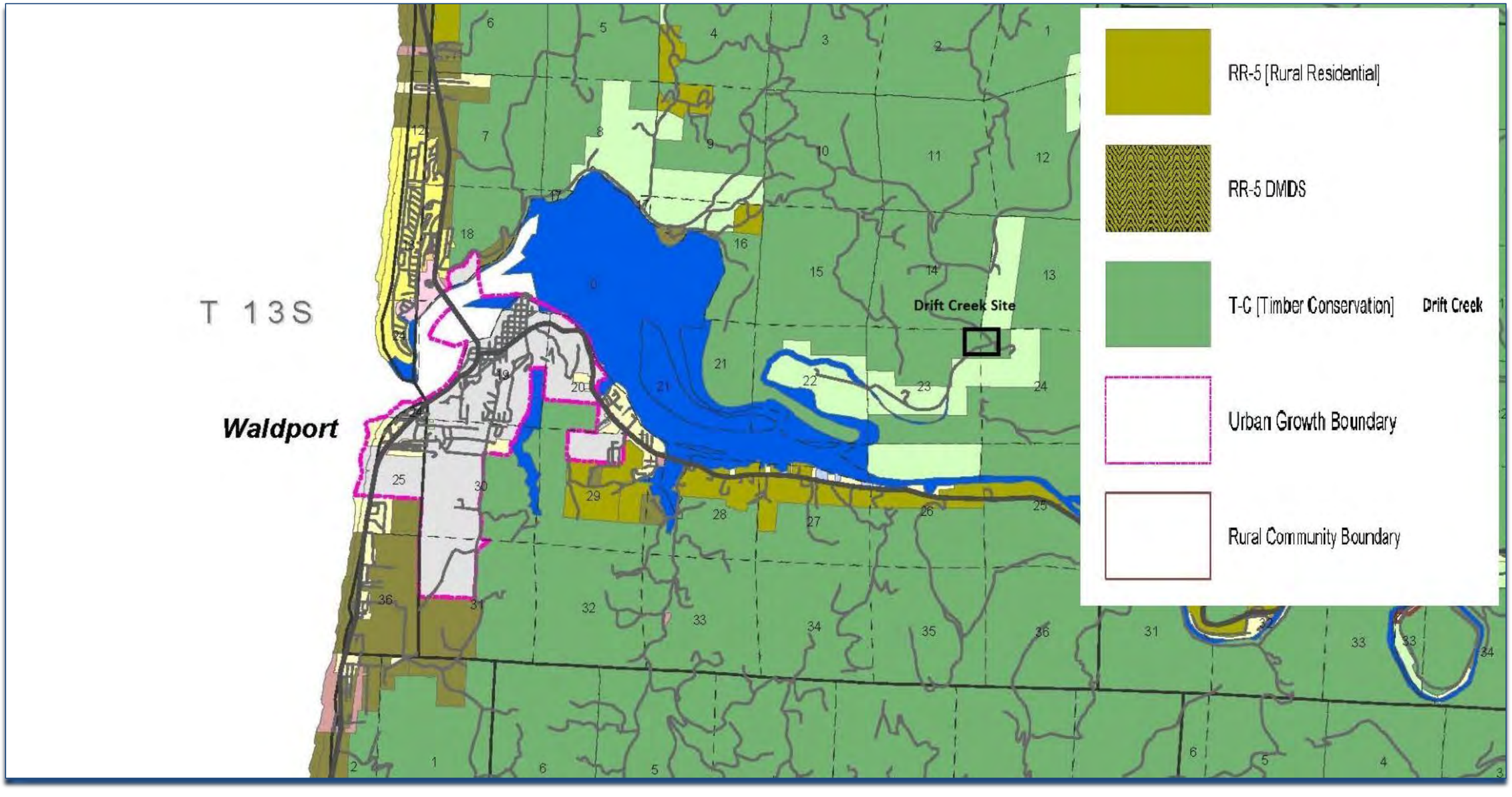
Ideally, Water Treatment Plant locations should be above the 100-year flood zone. Both of the Drift Creek POD sites adjacent to the Creek are in a flood zone. The site location as shown in Figure 3.4.c for Drift Creek Site 2 is outside of this flood area. This location is in a recently cleared forest area in the Siuslaw National Forest. This location would need a booster pump station to lift treated water into the existing distribution system. The size of the foot print of the treatment plant as shown on the schematic is a best guess and will vary depending on the manufacture and the quantity of flow treated. The water at this site may have higher salinity levels than some of the other water sources and therefore may require varied levels of water treatment. If testing results in water with high salinity during infrequent periods, brackish water existence can be accommodated by use of a conductivity measurement in the WTP feed to shut-down the plant feed for a variable period of time subsequently determined to allow the brackish water to exit the stretch of the creek from which the withdrawal is being made. This treatment plant would require disposal of the sediments from the pretreatment process and disposal of the backwash from the membrane filter in the secondary treatment process, see Section 2.2.

3.4.5 Location of Facilities

The suggested location of the infiltration gallery and the stream side wells for Site 2 can be seen on Figure 3.4.b. The prospective location for the treatment facility could be at a location near the ridge on Forest Service land at Site 2 as shown on Figure 3.4.b. There are multiple sites nearby on Forest Service property that could accommodate a treatment facility. The approximate distance from the POD would be 200-400 feet away with an approximate change in elevation of 30 feet. This area is zoned TC – Timber Conservation.

This location would require various pumps to move the water from different elevations and pressures zones. These facilities increase the initial construction cost and incur long-term operation and maintenance costs for power as well as equipment maintenance and replacement. When pumps can be reasonably avoided, utilization of gravity flow is always more desirable than pumping; especially when large pumping facilities are needed.

Figure 3.4.5 Zoning – Lincoln County – Drift Creek



3.4.6. Backwash Facilities

See the description in Section 2.2. This portion is the same for each water source at this point and will depend on the treatment process and water quality of the source.

3.4.7 Distribution

To connect treated water from the Drift Creek Site 2 location to the SRWD water distribution system will require a booster/pump (or several) station(s) to put the water into the pressure zone of the existing system. Connection to the existing system would require the placement of approximately 7.8 miles of new water line that would tie into the existing system at NW Cedar Crest Drive, see Figure 3.4.7. This distance, along with other factors, could be a significant deterrent from extracting raw water at this site. Longer lengths of water pipeline between the WTP and existing system could create more locations for outages and more pipelines to potentially fail. In addition, higher pressures in the pipeline could increase the chances of failure.

Figure 3.4.7 Drift Creek- Water Distribution Routes

3.4.8 Controls and Telemetry

Controls and telemetry will be monitored through SCADA (Supplementary Control and Data Acquisition) which will allow the District to receive warning signals about the functionality of the various facilities. The SCADA system can provide remote information and controls for the intake system(s), Water Treatment Facility, valves and booster pump. It is possible to install a SCADA system at the Drift Creek sites and connect to the rest of the District system, although these locations are considered rural and would incur possible communication breaks and issues with access for repairs.

3.4.9 Power

This location, as with all of the locations that will require a Water Treatment Plant will require three-phase power. This site will require three-phase power to be hooked up to it due to the pumps and treatment plant power requirements. New power connections would require a new pole, new transformer and an underground conduit placed from the transformer to the Water Treatment Plant. This site would be the most costly to install and connect to the closest power source because it is so remote. The WTP would also require a backup, emergency power supply. This would most likely be in the form of a large diesel generator.

3.4.10 Property Issues

The properties at Site 1 and Site 2 at Drift Creek are accessed by a County Maintained road. The existing utilities are within the County right of way. Site 1 is surrounded by privately owned land. There is a small portion that is Siuslaw National Forest Service land. Site 2 is located on, maintained by and surrounded by Siuslaw National Forest land.

3.4.11 Environmental and Permitting Issues Associated with Infrastructure

Any work within a waterway, particularly tidally influenced and navigable waters, will require a Joint Permit Application (JPA) submitted and coordinated by the Oregon Department of State Lands and the U.S. Army Corps of Engineers. Before the JPA is submitted, a wetland delineation should be performed and submitted to DSL. Depending on the location of the treatment facility and the entire “project area” the wetland delineation will most likely evaluate the entire subject area. Possible mitigation efforts may be necessary depending on how much, if any, wetlands or waters are impacted. If mitigation appears to be necessary, early coordination with local organizations such as the Mid-Coast Watersheds Council should be developed as early as possible.

Depending on the funding source a Biological Assessment will most likely be required and perhaps an Environmental Report. Efforts should be taken to avoid impacts in sensitive wetland areas and waterways. The Drift Creek area is part of the USFS restoration area. All work done in or near this area would need to be coordinated with the Forest Service as well.

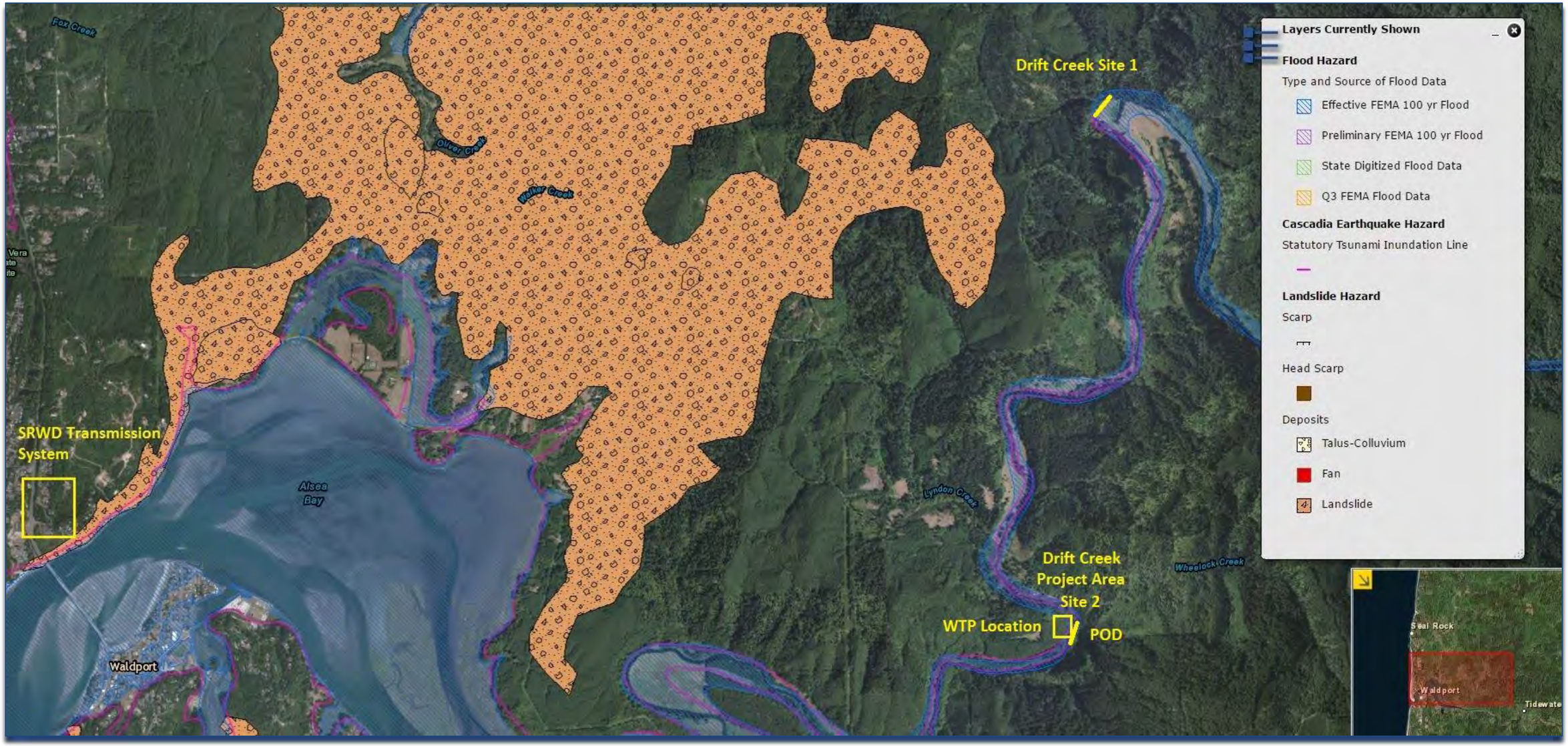
3.4.12 Risk and Threat Analysis

Water treatment facilities should be located above the projected 100 year flood elevation to avoid plausible issues with flooding. According to FEMA's Flood Insurance Rate Maps and the Oregon HazVu Viewer, the proposed location for the Water Treatment Facility (within the recently cleared forest area) is outside of the 100 year floodplain and the tsunami inundation area. The intake structures are all within the flood zone and tsunami inundation area. Modifications to the intake structures (stream side wells and infiltration galleries) could be accomplished to minimize impacts from flooding and tsunamis. There is also an advantage of installing infiltration galleries in flood areas because periodic flooding can help rinse the drainage area.

Facilities at Drift Creek have a low amount of risk of manmade threats. These locations are very remote and difficult to access. The facilities could be fenced off to deter possible vandals as well. `The headwaters of Drift Creek also extend for miles upriver and travel past lands that are used for timber and other agricultural uses. These activities could negatively affect the quality of water and require higher levels of water treatment.

Some facilities for both sites are within the flood plain and could experience damage in the event of severe flooding or tsunamis. There is also the threat of landslides or power outages. The primary threat for the raw water sites at Drift Creek are from the long raw water and treated water transmission lines. Several miles of transmission lines allow the system multiple points of possible failure. The transmission lines could leak of break for several reasons and, in the event of a formidable natural disaster, be difficult to access to repair. Figure 3.4.12 illustrates the potential for encountering natural disasters between the Drift Creek Site and the District's water distribution system.

Figure 3.4.12 Natural Hazards – Drift Creek



3.5 Seal Rock Water District – Current Water Source – City of Toledo

3.5.1 Raw Water Summary

The sources of raw water supply for the City, and the Seal Rock Water District, are the Siletz River and Mill Creek. Mill Creek includes a dam built around 1965 with a reservoir providing 250 acre-feet of storage. Due to seasonal variations in water quality, Mill Creek is used in winter months when turbidity in the Siletz is high, and the Siletz is used in summer when algae blooms degrade Mill Creek water quality and Mill Creek flows are inadequate.

In 1972, the City of Toledo coordinated with the Seal Rock Water District to utilize the Siletz River as a mutual water source and to construct an intertie between the two communities with treatment occurring in Toledo. This long-range water supply plan was approved by the Lincoln County Board of Commissioners in 1974. The two communities then split the costs and constructed the 1979 Toledo Water Treatment Plant (WTP), some improvements to the Siletz River raw water piping, and the Seal Rock intertie pipeline and pumping station.

Rebuilding the supply infrastructure on the Siletz River and Mill Creek are current capital improvement projects in the Toledo Water Master Plan. A new intake structure on the Siletz is expected to be complete in 2015. Various other improvements are also underway at the Toledo Water Treatment Plant for maintenance and capacity building reasons. The District is liable for half the costs of these improvements and also pays the City of Toledo for the water they receive.

3.5.2 Raw Water Transmission

Both Mill Creek and the Siletz River sources require significant amounts of piping to convey water to the City of Toledo. The Mill Creek transmission piping is approximately 5.3 miles long and flows by gravity to the 40+ year old Mill Creek pump station in the City of Toledo, which lifts the water to the treatment plant. The Siletz River transmission piping is approximately 6.4 miles long and delivers water from the Siletz River pump station, on the bank of the Siletz River, which pumps water all the way to the treatment plant. Recent work to the Siletz River pipeline replaced the oldest section of the pipe which crossed the Olalla Reservoir.

3.5.3 Raw Water Storage/Impoundment

The SRWD has two water storage tanks currently in use; the 0.9 MG Driftwood Storage Tank and the 1.4 MG Lost Creek Storage Tank for a total of 2.3 million gallons of treated water storage.
The Driftwood Tank is a welded Cor-Ten steel tank constructed in 1981 with a water surface elevation of 265.5 feet. The Lost Creek Tank is a glass-fused-to-steel tank constructed in 2005 with a water surface elevation of 301 feet. A pressure reducing valve drops pressure from the Lost Creek Tank discharge to match the 265.5 foot hydraulic grade of the Driftwood Tank.

3.5.4 Raw Water Treatment

The City of Toledo Water Treatment Plant was constructed in 1976 and received some upgrades in 2000. The major plant components have adequate capacity to serve the City plus the District for the planning period although some minor capacity increases and maintenance improvements are needed. A chlorine booster station exists near the District end of the 50,000 foot transmission piping to ensure proper free chlorine residuals in the District distribution system. This equipment boosts the free chlorine residual from around 0.6 mg/L up to 1.2 mg/L. As of 2015, there are ongoing upgrades and maintenance occurring at the WTP. Some of these improvements are chemical room modifications, clear and wet well repairs and leak repairs.

3.5.5 Location of Facilities

The existing POD/intake structures are on the Siletz River and Mill Creek. The Water Treatment Plant is located in the City of Toledo, Oregon. Pump stations and water distribution piping are located throughout the system, from the Siletz River to the City of Toledo and within the District.

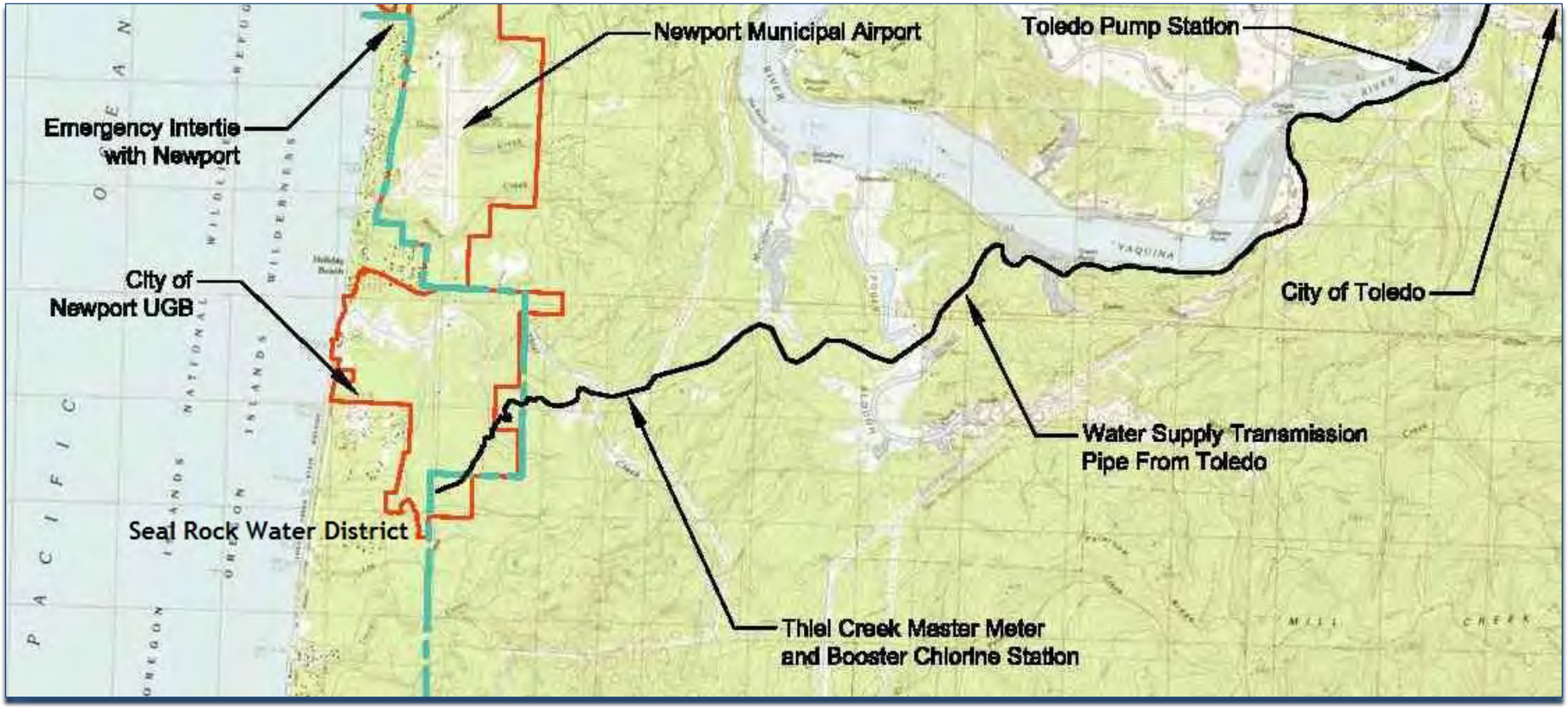
3.5.6 Backwash Facilities

The WTP consists of two side-by-side identical treatment trains in exterior concrete basins with a chemical feed and storage room, a lower equipment/pipe gallery room, an upper control room overlooking the treatment basins, and a fairly deep concrete-walled backwash waste basin. The plant pumps including a backwash pump, surface wash pump, plant water supply pump, and booster pump are located outside over a wet well type basin adjacent to the clear well. The filters at the Toledo WTP are backwashed between 8 and 16 times per month (total for both filters). Backwash waste water is dumped into the 100,000 gallon backwash waste basin prior to being discharged into the municipal sanitary sewer system.

3.5.7 Distribution

Distribution refers to the transmission piping and booster pumps required to deliver the finished water from the treatment plant to the District's water system. Treated water travels through approximately 9.5 miles of 12-inch dedicated transmission piping to the Seal Rock Water District. Even though the Toledo system and the Seal Rock system are at the same hydraulic grade of approximately 300 feet above sea level, a pump station exists (called the Toledo Pump Station) nearer to the city to overcome pipe friction and deliver water to the District quickly. A master meter exists to measure flows entering the SRWD system from Toledo. Figure 3.5.7 is a schematic showing treated water transmission route from Toledo to the District.

Figure 3.5.7 Water Transmission Toledo to SRWD



3.5.8 Controls and Telemetry

Controls and telemetry are monitored through SCADA (Supplementary Control and Data Acquisition) for both the City of Toledo and the Seal Rock Water District.

3.5.9 Power

The intake systems pump stations and WTP currently in use operate using three-phase power.

3.5.10 Property Issues

The City of Toledo has all easements in place for the water transmission lines.

3.5.11 Environmental and Permitting Issues Associated with Infrastructure

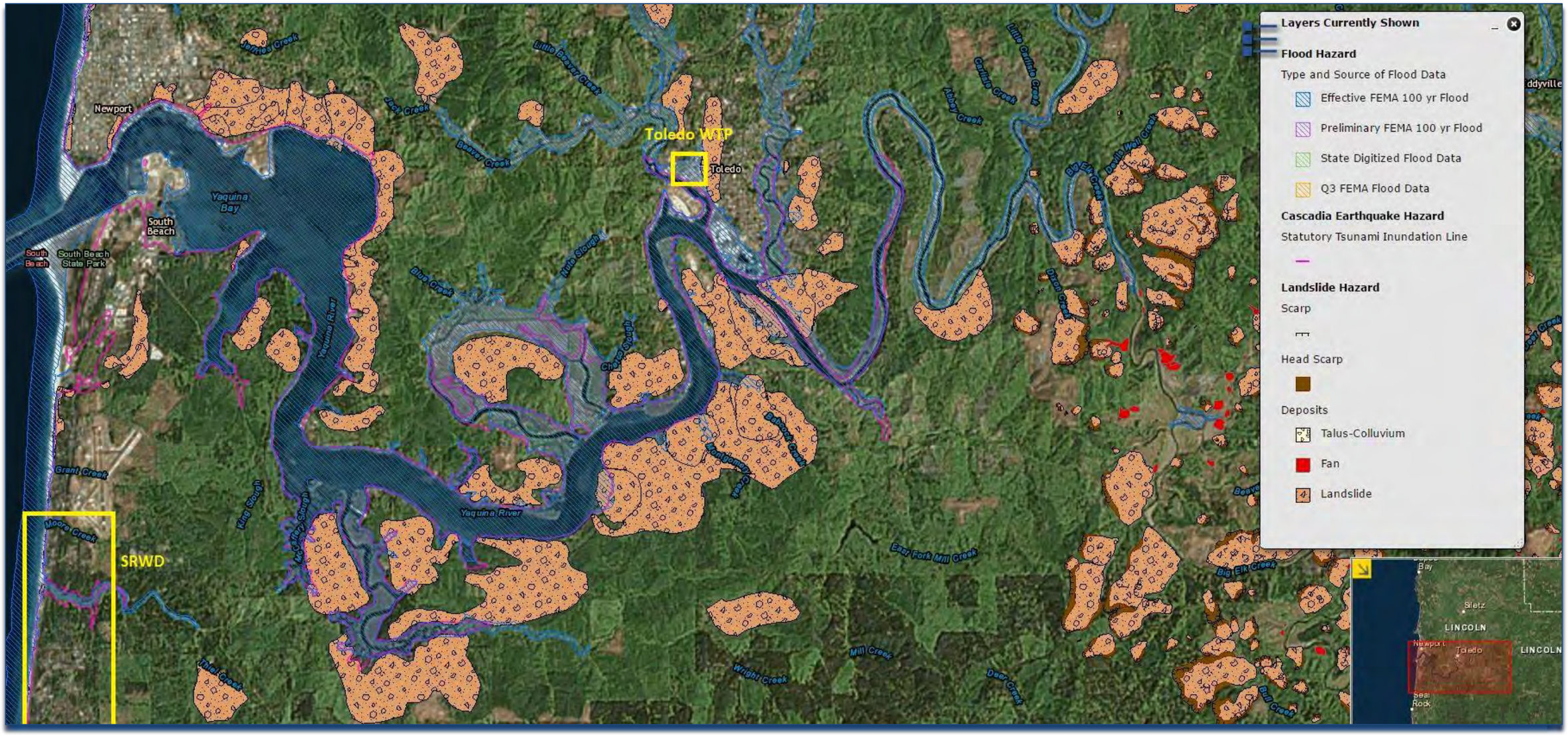
To begin the recent intake improvements the City of Toledo was required to complete a Biological Assessment, a Preliminary Engineering Report, an Environmental Report, a Joint Permit Application, a Cultural Evaluation and a wetland delineation.

3.5.12 Risk and Threat Analysis

Facilities at the City of Toledo have a moderate amount of risk of manmade threats. The City keeps the infrastructure secure and does not have a history of vandalism. The intake systems and some pump station are remote and are in areas that are frequently used in the summer months; therefore have a moderate amount of risk associated with human activities.

Facilities for both intake sites are within the flood plain and could experience damage in the event of severe flooding and debris. There is also the threat of landslides or power outages. The primary threat for the raw water sites for Toledo are from the long raw water and treated water transmission lines, 6.3 miles from the Siletz River and 5.4 miles from Mill Creek. Several miles of transmission lines allow the system multiple points of possible failure. The transmission lines could leak or break for several reasons and, in the event of a formidable natural disaster, be difficult to access to repair. If the raw water transmission lines were broken, this would result in both the City of Toledo and the Seal Rock Water District being cut off from the water source. Similar threats exist for the treated water that is transported via the approximate 10 miles from Toledo to the District. This transmission line passes through areas that are prone to landslides, flooding and are in tsunami inundation zones.

Figure 3.5.12 Natural Hazards – Toledo to SRWD



4.0 Raw Water Source Cost Summary Tables

This section will provide a summary of the cost estimates associated with developing the above-discussed 13 subsections required for the development of new raw water sources within the District. The cost estimates will be broken down into Budgetary Capital Construction cost estimates, Operation and Maintenance (O&M) costs, Long Term Maintenance Items, all costs are summarized in Net Present Values.

4.1 Capital Construction Cost Estimates

Capital cost considerations will include; modifications to existing infrastructure and intake construction, treatment plant, piping, pumps, electrical and power improvements, telemetry, and additional items related to constructing an operational Water Treatment Plant. The cost estimates will also incorporate easements, land acquisition, potential mitigation as well as permitting and administrative costs. The Budgetary Capital Construction Costs for each raw water source and the No Action option of continuing to purchase water from Toledo are outlined below.

4.1.1 *Henderson Creek*

Henderson Creek Raw Water Supply- Estimate of Capital Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Bonding, Insurance Etc.	Bond, insurance, overhead, and mobilization (18%)	ls	1	$550,000	$550,000
Raw Water Intake	Diversion Dam Repair	ls	1	$40,000	$40,000
	Intake, Pump & Screen	ls	1	$55,000	$55,000
Water Treatment Plant	Site grading and preparation	ls	1	$15,000	$15,000
	Site and process piping	ls	1	$50,000	$50,000
	CMU Building W/ Metal Roof	sf	2000	$250	$500,000
	Membrane filtration equipment	ls	1	$800,000	$800,000
	Clearwell and disinfection equipment	ls	1	$325,000	$325,000
	Mechanical and plant pumps	ls	1	$125,000	$125,000
	Backwash waste storage	ls	1	$100,000	$100,000
Water Transmission	Raw Water	lf	100	$120	$12,000
	Booster Pump	ls	1	$125,000	$125,000
	Treated water transmission	lf	1500	$120	$180,000
Power and Communications	Master meter and vault	ls	1	$15,000	$15,000
	Electrical-Plant	ls	1	$200,000	$200,000
	Controls and instrumentation (SCADA)	ls	1	$100,000	$100,000
	Communications equipment-Mechanical	ls	1	$15,000	$15,000
	3 Phase Power & Transformer-Overhead	ls	1	$25,000	$25,000
	Backup power generation equipment	ls	1	$80,000	$80,000
Land	Land Acquisition & Easements	ls	1	$200,000	$200,000
	Environmental Mitigation	ls	1	$25,000	$25,000
Etc.	Fencing w/ Gate	ls	1	$25,000	$25,000

Construction Total	$3,012,000
Construction Admin (22%)	$662,640
Contingency (20%)	$602,400
Legal and Permitting (10%)	$301,200
Total Project Costs	$5,128,240

4.1.2 *Thiel Creek*

Thiel Creek Raw Water Supply- Estimate of Capital Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Bonding, Insurance Etc.	Bond, insurance, overhead, and mobilization (18%)	ls	1	$630,000	$630,000
Raw Water Intake	Intake, Pump & Sand Separator	ls	1	$55,000	$55,000
	Raw Water Storage Tank	ls	1	$210,000	$210,000
	Infiltration Gallery/Well	ls	1	$55,000	$55,000
Water Treatment Plant	Site grading and preparation	ls	1	$15,000	$15,000
	Site and process piping	ls	1	$50,000	$50,000
	CMU Building W/ Metal Roof	sf	2000	$250	$500,000
	Membrane filtration equipment	ls	1	$800,000	$800,000
	Clearwell and disinfection equipment	ls	1	$325,000	$325,000
	Mechanical and plant pumps	ls	1	$100,000	$100,000
	Backwash waste storage	ls	1	$100,000	$100,000
Water Transmission	Raw water transmission	lf	400	$120	$48,000
	Booster Pump	ls	1	$100,000	$100,000
	Treated water transmission	lf	50	$120	$6,000
Power and Communications	Master meter and vault	ls	1	$15,000	$15,000
	Electrical-Plant	ls	1	$200,000	$200,000
	Controls and instrumentation (SCADA)	ls	1	$100,000	$100,000
	Communications equipment- Mechanical	ls	1	$15,000	$15,000
	3 Phase Power & Transformer-Underground	lf	3000	$75	$225,000
	Backup power generation equipment	ls	1	$80,000	$80,000
Land	Land Acquisition & Easements	ls	1	$400,000	$400,000
	Environmental Mitigation	ls	1	$75,000	$75,000
Misc.	Fencing W/Gate	ls	1	$25,000	$25,000

Construction Total	$3,499,000
Construction Admin (22%)	$769,780
Contingency (20%)	$699,800
Legal and Permitting (10%)	$349,900
Total Project Costs	$5,948,480

4.1.3 *Beaver Creek*

Beaver Creek Raw Water Supply- Estimate of Capital Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Bonding, Insurance Etc.	Bond, insurance, overhead, and mobilization (18%)	ls	1	$790,000	$790,000
Raw Water Intake	Intake, Pump & Sand Separator	ls	1	$75,000	$75,000
	Raw Water Storage Tank	ls	1	$210,000	$210,000
	Infiltration Gallery/Well	ls	1	$55,000	$55,000
Water Treatment Plant	Site grading and preparation	ls	1	$25,000	$25,000
	Site and process piping	ls	1	$50,000	$50,000
	CMU Building W/ Metal Roof	sf	2000	$250	$500,000
	Membrane filtration equipment	ls	1	$800,000	$800,000
	Clearwell and disinfection equipment	ls	1	$325,000	$325,000
	Mechanical and plant pumps	ls	1	$175,000	$175,000
	Backwash waste storage	ls	1	$100,000	$100,000
Water Transmission	Raw water transmission	lf	500	$120	$60,000
	Booster Pump	ls	1	$150,000	$150,000
	Treated water transmission	lf	7000	$120	$840,000
Power and Communications	Master meter and vault	ls	1	$15,000	$15,000
	Electrical-Plant	ls	1	$200,000	$200,000
	Controls and instrumentation (SCADA)	ls	1	$100,000	$100,000
	Communications equipment- Mechanical	ls	1	$15,000	$15,000
	3 Phase Power & Transformer-Underground	lf	1400	$75	$105,000
	Backup power generation equipment	ls	1	$80,000	$80,000
Land	Land Acquisition & Easements	ls	1	$400,000	$400,000
	Environmental Mitigation	ls	1	$75,000	$75,000
Misc.	Fencing W/Gate	ls	1	$25,000	$25,000

Construction Total	$4,380,000
Construction Admin (22%)	$963,600
Contingency (20%)	$876,000
Legal and Permitting (10%)	$438,000
Total Project Costs	$7,447,600

4.1.4 *Drift Creek*

Drift Creek Raw Water Supply- Estimate of Capital Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Bonding, Insurance Etc.	Bond, insurance, overhead, and mobilization (18%)	ls	1	$1,530,000	$1,530,000
Raw Water Intake	Intake, Pump & Sand Separator	ls	1	$55,000	$55,000
	Raw Water Storage Tank	ls	1	$210,000	$210,000
	Infiltration Gallery/Well	ls	1	$55,000	$55,000
Water Treatment Plant	Site grading and preparation	ls	1	$15,000	$15,000
	Site and process piping	ls	1	$50,000	$50,000
	CMU Building W/ Metal Roof	sf	2000	$250	$500,000
	Membrane filtration equipment	ls	1	$800,000	$800,000
	Clearwell and disinfection equipment	ls	1	$325,000	$325,000
	Mechanical and pumps	ls	1	$250,000	$250,000
	Backwash waste storage	ls	1	$100,000	$100,000
Water Transmission	Raw water transmission-Site 2	lf	200	$120	$24,000
	Booster Pump	ls	1	$200,000	$200,000
	Treated water transmission	lf	41000	$120	$4,920,000
Power and Communications	Master meter and vault	ls	1	$15,000	$15,000
	Electrical-Plant	ls	1	$200,000	$200,000
	Controls and instrumentation (SCADA)	ls	1	$100,000	$100,000
	Communications equipment- Mechanical	ls	1	$15,000	$15,000
	3 Phase Power & Transformer-Underground	lf	1400	$75	$105,000
	Backup power generation equipment	ls	1	$80,000	$80,000
Land	Land Acquisition & Easements	ls	1	$400,000	$400,000
	Environmental Mitigation	ls	1	$75,000	$75,000
Misc.	Fencing W/Gate	ls	1	$25,000	$25,000

Construction Total	$8,519,000
Construction Admin (22%)	$1,874,180
Contingency (20%)	$1,703,800
Legal and Permitting (10%)	$851,900
Total Project Costs	$14,478,880

4.1.5 *Toledo*

Toledo Water Supply- Estimate of Capital Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Raw Water Intake	Schedule A Olalla Crossing	ls	1	$438,130	$438,130
	Schedule B Siletz River Intake	ls	1	$2,201,093	$2,201,093
	Construction Management/Inspection	ls	1	$632,761	$632,761
Water Treatment Plant	WTP Maintenance and Improvements	ls	1	$949,503	$949,503
Future Capital Improvements	Phase 3 Capital Improvements	ls	1	$429,903	$429,903
	Phase 4 Capital Improvements	ls	1	$13,884,180	$13,884,180

Construction Total	$18,535,570
Costs to SRWD (Total/2)	$9,267,785
Total Project Costs	$9,267,785

4.2 Annual O&M Cost Estimates and Long Term Maintenance

Operation and Maintenance (O & M) considerations will include; operator costs, repairs and maintenance, replacement costs for consumables, power usage costs, and miscellaneous fees and testing. This are calculated on an annual basis.

Estimated Long Term Maintenance items are larger and generally more expensive equipment that requires replacement every 10-20 years. Examples of these items are filter membranes and intake, plant and booster pumps.

The Annual O&M Costs and Long Term Maintenance Items for each water source and the City of Toledo are outlined below.

4.2.1 *Henderson Creek*

Henderson Creek Raw Water Supply- Estimate of Annual Operation and Maintenance (O&M) Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Operator	Level 3 operator at 2 hours/day (7 months/year)	hr	427	$65	$27,755
Chemical	Chlorine	ls	1	$5,000	$5,000
	Polymer	ls	1	$8,000	$8,000
Mechanical	Routine Repairs and Maintenance	ls	1	$20,000	$20,000
Fees and Testing	Bacteriological analysis	ea	180	$40	$7,200
	Misc fees and testing	ls	1	$10,000	$10,000
Power	Power costs	Kw-h	73500	0.10	$7,350

AnnualO&M Total	$85,305
Contingency (20%)	$17,061
Total Annual O&M Costs	$130,121

Henderson Creek Raw Water Supply- Estimate of Long-Term Maintenance Items				
Item Description	Life Span	Quantity	Unit Cost	Total Cost
Filter Membrane replacement	10	1	$18,000	$18,000
Intake pump replacement	20	2	$15,000	$30,000
Plant pump replacement	20	2	$35,000	$70,000
Booster system pump replacement	20	2	$35,000	$70,000

4.2.2 *Thiel Creek*

Thiel Creek Raw Water Supply- Estimate of Annual Operation and Maintenance (O&M) Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Operator	Level 3 operator at 2 hours/day (12 months/year)	hr	730	$65	$47,450
Chemical	Chlorine	ls	1	$10,000	$10,000
	Polymer	ls	1	$16,000	$16,000
Mechanical	Routine Repairs and Maintenance	ls	1	$20,000	$20,000
Fees and Testing	Bacteriological analysis	ea	365	$40	$14,600
	Misc fees and testing	ls	1	$10,000	$10,000
Power	Power costs	Kw-h	122500	0.10	$12,250

AnnualO&M Total	$130,300
Contingency (20%)	$26,060
Total Annual O&M Costs	$203,810

Thiel Creek Raw Water Supply- Estimate of Long-Term Maintenance Items				
Item Description	Life Span	Quantity	Unit Cost	Total Cost
Filter Membrane replacement	10	1	$18,000	$18,000
Intake pump replacement	20	2	$15,000	$30,000
Plant pump replacement	20	2	$35,000	$70,000
Booster system pump replacement	20	2	$30,000	$60,000

4.2.3 *Beaver Creek*

Beaver Creek Raw Water Supply- Estimate of Annual Operation and Maintenance (O&M) Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Operator	Level 3 operator at 2 hours/day (12 months/year)	hr	730	$65	$47,450
Chemical	Chlorine	ls	1	$10,000	$10,000
	Polymer	ls	1	$16,000	$16,000
Mechanical	Routine Repairs and Maintenance	ls	1	$20,000	$20,000
Fees and Testing	Bacteriological analysis	ea	365	$40	$14,600
	Misc fees and testing	ls	1	$10,000	$10,000
Power	Power costs	Kw-h	171500	0.10	$17,150

AnnualO&M Total	$135,200
Contingency (20%)	$27,040
Total Annual O&M Costs	$209,690

Beaver Creek Raw Water Supply- Estimate of Long-Term Maintenance Items				
Item Description	Life Span	Quantity	Unit Cost	Total Cost
Filter Membrane replacement	10	1	$18,000	$18,000
Intake pump replacement	20	2	$15,000	$30,000
Plant pump replacement	20	2	$35,000	$70,000
Booster system pump replacement	20	2	$40,000	$80,000

4.2.4 *Drift Creek*

Drift Creek Raw Water Supply- Estimate of Annual Operation and Maintenance (O&M) Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Operator	Level 3 operator at 2 hours/day (10 months/year)	hr	608	$65	$39,542
Chemical	Chlorine	ls	1	$10,000	$10,000
	Polymer	ls	1	$16,000	$16,000
Mechanical	Routine Repairs and Maintenance	ls	1	$20,000	$20,000
Fees and Testing	Bacteriological analysis	ea	365	$40	$14,600
	Misc fees and testing	ls	1	$10,000	$10,000
Power	Power costs	Kw-h	245000	0.10	$24,500

AnnualO&M Total	$134,642
Contingency (20%)	$26,928
Total Annual O&M Costs	$201,112

Drift Creek Raw Water Supply- Estimate of Long-Term Maintenance Items				
Item Description	Life Span	Quantity	Unit Cost	Total Cost
Filter Membrane replacement	10	1	$18,000	$18,000
Intake pump replacement	20	2	$15,000	$30,000
Plant pump replacement	20	2	$35,000	$70,000
Booster system pump replacement	20	2	$50,000	$100,000

4.2.4 *Toledo*

Toledo Water Supply- Estimate of Annual Operation and Maintenance (O&M) Costs					
Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
Operator	Grade 3 operator 2 hrs/day (12 Months/Year)	hr	730	$65	$47,450
Chemical	Chlorine	ls	1	$5,000	$5,000
	Polymer	ls	1	$8,000	$8,000
Mechanical	Filter replacement	ls	1	$18,000	$18,000
	Intake pump replacement (year 20)	ls	1	$20,000	$20,000
	Plant pump replacement (year 20)	ls	1	$70,000	$70,000
	Booster system pump replacement (year 20)	ls	1	$65,000	$65,000
	Repairs and Maintenance	ls	1	$20,000	$20,000
Fees and Testing	Bacteriological analysis	ea	180	$40	$7,200
	Misc fees and testing	ls	1	$10,000	$10,000
Power	Power costs	Kw-h	49000	0.10	$4,900
			20 Year O&M Total		$275,550
			Contingency (20%)		$55,110
			Total Project Costs		$378,110

4.3 Net Present Value Analysis

Net Present Value (NPV) is used to determine the present value of an investment by the discounted sum of all cash flows received from the project. Analyzing costs using NPV allows planners to view various options in present day values. For this Memo, all four raw water source options were assessed along with the No Action option, the current source of water for the SRWD. To calculate the Net Present Values several value assumptions or established values need to be used. The input values that were used to generate the NPVs are:

- The Capital Construction Costs
- The Annual O&M Costs
- The Long Term Maintenance Costs
- A 20 Year time span, consistent with the future demand discussed in the GSI Memo
- A 4% Discount Rate
- $3.41 as the rate that Toledo charges the District per 1,000 gallons treated water
- A 2.25% Interest Rate used for USDA 30 year loans
- A 40% salvage percent
- Population increases consistent with the SRWD Water Master Plan
- To estimate the construction costs for long term construction items such as Phase 4 Improvements and the Long Term Maintenance Items, the percent change in the ENR CCI[6] from 2010-2015 was calculated then extrapolated out to 2035 and applied to the NPV
- Assuming zero grant monies

4.3.1 *NPV Summary*

Table 4.3.1 Summary of Costs

Water Source	Capital Cost Estimate	Annual O&M Cost Estimate	Net Present Value
Henderson Creek	$5,128,240	$130,121	$9,942,108
Thiel Creek	$5,948,480	$203,810	$8,319,484
Beaver Creek	$7,447,600	$209,690	$9,108,697
Drift Creek	$14,478,880	$201,112	$13,347,912
City of Toledo	$9,267,785	$378,110	$9,775,165

4.3.2 *NPV Analysis Table*

[6] Construction Cost Indexes used from Engineering News-Record

Figure 4.3.2 Net Present Value Analysis Table

	EDU Served		2,950	3,023	3,096	3,169	3,242	3,315	3,388	3,461	3,534	3,607	3,680	3,753	3,826	3,899	3,972	4,045	4,118	4,191	4,264	4,337	4,410	Salvage
Salvage	SWRD Water Consumption (ADD * 365), in 1,000 gallons		145,834	148,363	150,892	153,421	155,950	158,479	161,009	163,538	166,067	168,596	171,125	173,654	176,183	178,713	181,242	183,771	186,300	188,829	191,358	193,888	196,417	
	Alternative	Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
	No Build (Remain w/ Toledo)																							
40%	Toledo Phase 2 Capital		$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ (844,297)
40%	Toledo Phase 3&4 Capital												$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ 330,651	$ (2,862,817)
	Cost of Water (Incl. Toledo O&M)		$ 497,292	$ 505,917	$ 514,541	$ 523,166	$ 531,790	$ 540,415	$ 549,039	$ 557,663	$ 566,288	$ 574,912	$ 583,537	$ 592,161	$ 600,786	$ 609,410	$ 618,034	$ 626,659	$ 635,283	$ 643,908	$ 652,532	$ 661,157	$ 669,781	
	Annual Total		$ 594,807	$ 603,432	$ 612,056	$ 620,681	$ 629,305	$ 637,930	$ 646,554	$ 655,178	$ 663,803	$ 672,427	$ 1,011,702	$ 1,020,327	$ 1,028,951	$ 1,037,576	$ 1,046,200	$ 1,054,824	$ 1,063,449	$ 1,072,073	$ 1,080,698	$ 1,089,322	$ 1,097,947	$ (3,707,114)
	Annual Impact to Rate Payer (Annual)		$ 201.63	$ 199.61	$ 197.69	$ 195.86	$ 194.11	$ 192.44	$ 190.84	$ 189.30	$ 187.83	$ 186.42	$ 274.92	$ 271.87	$ 268.94	$ 266.11	$ 263.39	$ 260.77	$ 258.24	$ 255.80	$ 253.45	$ 251.17	$ 248.97	
	Annual Impact to Rate Payer (Monthly)		$ 16.80	$ 16.63	$ 16.47	$ 16.32	$ 16.18	$ 16.04	$ 15.90	$ 15.78	$ 15.65	$ 15.54	$ 22.91	$ 22.66	$ 22.41	$ 22.18	$ 21.95	$ 21.73	$ 21.52	$ 21.32	$ 21.12	$ 20.93	$ 20.75	
	NPV	**$9,775,165**																						
	Henderson Creek																							
	Toledo Phase 2 Capital		$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	
	Interim Water from Toledo		$ 497,292	$ 505,917	$ 257,271	$ 261,583	$ 265,895	$ 270,207	$ 274,520	$ 278,832	$ 283,144	$ 287,456	$ 291,768	$ 296,081	$ 300,393	$ 304,705	$ 309,017	$ 313,329	$ 317,642	$ 321,954	$ 326,266	$ 330,578	$ 334,891	
40%	Capital Improvement Costs				$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ 236,921	$ (1,204,800)
	Annual O&M				$ 115,401	$ 117,335	$ 119,269	$ 121,204	$ 123,138	$ 125,072	$ 127,007	$ 128,941	$ 130,875	$ 132,809	$ 134,744	$ 136,678	$ 138,612	$ 140,546	$ 142,481	$ 144,415	$ 146,349	$ 148,284	$ 150,218	
	Long-Term Maintenance												$ 22,662										$ 285,379	
	Annual Total		$ 594,807	$ 603,432	$ 707,108	$ 713,354	$ 719,601	$ 725,847	$ 732,094	$ 738,340	$ 744,587	$ 750,833	$ 779,741	$ 763,326	$ 769,573	$ 775,819	$ 782,066	$ 788,312	$ 794,559	$ 800,805	$ 807,052	$ 813,298	$ 1,104,924	$ (1,204,800)
	Annual Impact to Rate Payer (Annual)		$ 201.63	$ 199.61	$ 228.39	$ 225.10	$ 221.96	$ 218.96	$ 216.08	$ 213.33	$ 210.69	$ 208.16	$ 211.89	$ 203.39	$ 201.14	$ 198.98	$ 196.89	$ 194.89	$ 192.95	$ 191.08	$ 189.27	$ 187.53	$ 250.55	
	Annual Impact to Rate Payer (Monthly)		$ 16.80	$ 16.63	$ 19.03	$ 18.76	$ 18.50	$ 18.25	$ 18.01	$ 17.78	$ 17.56	$ 17.35	$ 17.66	$ 16.95	$ 16.76	$ 16.58	$ 16.41	$ 16.24	$ 16.08	$ 15.92	$ 15.77	$ 15.63	$ 20.88	
	NPV	**$9,942,108**																						
	Thiel Creek																							
	Toledo Phase 2 Capital		$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	
	Interim Water from Toledo		$ 497,292	$ 505,917	$ 257,271																			
40%	Capital Improvement Costs				$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ 274,816	$ (1,399,600)
	Annual O&M				$ 210,879	$ 214,414	$ 217,949	$ 221,483	$ 225,018	$ 228,552	$ 232,087	$ 235,622	$ 239,156	$ 242,691	$ 246,226	$ 249,760	$ 253,295	$ 256,829	$ 260,364	$ 263,899	$ 267,433	$ 270,968	$ 274,503	
	Long-Term Maintenance												$ 22,662										$ 270,199	
	Annual Total		$ 594,807	$ 603,432	$ 840,481	$ 586,745	$ 590,279	$ 593,814	$ 597,349	$ 600,883	$ 604,418	$ 607,952	$ 634,149	$ 615,022	$ 618,556	$ 622,091	$ 625,626	$ 629,160	$ 632,695	$ 636,230	$ 639,764	$ 643,299	$ 917,033	$ (1,399,600)
	Annual Impact to Rate Payer (Annual)		$ 201.63	$ 199.61	$ 271.47	$ 185.15	$ 182.07	$ 179.13	$ 176.31	$ 173.62	$ 171.03	$ 168.55	$ 172.32	$ 163.87	$ 161.67	$ 159.55	$ 157.51	$ 155.54	$ 153.64	$ 151.81	$ 150.04	$ 148.33	$ 207.94	
	Annual Impact to Rate Payer (Monthly)		$ 16.80	$ 16.63	$ 22.62	$ 15.43	$ 15.17	$ 14.93	$ 14.69	$ 14.47	$ 14.25	$ 14.05	$ 14.36	$ 13.66	$ 13.47	$ 13.30	$ 13.13	$ 12.96	$ 12.80	$ 12.65	$ 12.50	$ 12.36	$ 17.33	
	NPV	**$8,319,484**																						
	Beaver Creek																							
	Toledo Phase 2 Capital		$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	
	Interim Water from Toledo		$ 497,292	$ 505,917	$ 257,271																			
40%	Capital Improvement Costs				$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ 344,074	$ (1,752,000)
	Annual O&M				$ 216,963	$ 220,600	$ 224,236	$ 227,873	$ 231,510	$ 235,146	$ 238,783	$ 242,419	$ 246,056	$ 249,693	$ 253,329	$ 256,966	$ 260,602	$ 264,239	$ 267,876	$ 271,512	$ 275,149	$ 278,786	$ 282,422	
	Long-Term Maintenance												$ 22,662										$ 300,559	
	Annual Total		$ 594,807	$ 603,432	$ 915,823	$ 662,189	$ 665,826	$ 669,462	$ 673,099	$ 676,735	$ 680,372	$ 684,009	$ 710,307	$ 691,282	$ 694,918	$ 698,555	$ 702,192	$ 705,828	$ 709,465	$ 713,101	$ 716,738	$ 720,375	$ 1,024,570	$ (1,752,000)
	Annual Impact to Rate Payer (Annual)		$ 201.63	$ 199.61	$ 295.81	$ 208.96	$ 205.37	$ 201.95	$ 198.67	$ 195.53	$ 192.52	$ 189.63	$ 193.02	$ 184.19	$ 181.63	$ 179.16	$ 176.79	$ 174.49	$ 172.28	$ 170.15	$ 168.09	$ 166.10	$ 232.33	
	Annual Impact to Rate Payer (Monthly)		$ 16.80	$ 16.63	$ 24.65	$ 17.41	$ 17.11	$ 16.83	$ 16.56	$ 16.29	$ 16.04	$ 15.80	$ 16.08	$ 15.35	$ 15.14	$ 14.93	$ 14.73	$ 14.54	$ 14.36	$ 14.18	$ 14.01	$ 13.84	$ 19.36	
	NPV	**$9,108,697**																						
	Drift Creek																							
	Toledo Phase 2 Capital		$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	$ 97,515	
	Interim Water from Toledo		$ 497,292	$ 505,917	$ 257,271	$ 87,194	$ 88,632	$ 90,069	$ 91,507	$ 92,944	$ 94,381	$ 95,819	$ 97,256	$ 98,694	$ 100,131	$ 101,568	$ 103,006	$ 104,443	$ 105,881	$ 107,318	$ 108,755	$ 110,193	$ 111,630	
40%	Capital Improvement Costs				$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ 668,915	$ (3,407,600)
	Annual O&M				$ 208,087	$ 211,575	$ 215,063	$ 218,551	$ 222,039	$ 225,527	$ 229,014	$ 232,502	$ 235,990	$ 239,478	$ 242,966	$ 246,454	$ 249,941	$ 253,429	$ 256,917	$ 260,405	$ 263,893	$ 267,381	$ 270,868	
	Long-Term Maintenance												$ 22,662										$ 330,918	
	Annual Total		$ 594,807	$ 603,432	$ 1,231,788	$ 1,065,199	$ 1,070,124	$ 1,075,050	$ 1,079,975	$ 1,084,900	$ 1,089,825	$ 1,094,751	$ 1,122,338	$ 1,104,601	$ 1,109,526	$ 1,114,452	$ 1,119,377	$ 1,124,302	$ 1,129,227	$ 1,134,152	$ 1,139,078	$ 1,144,003	$ 1,479,846	$ (3,407,600)
	Annual Impact to Rate Payer (Annual)		$ 201.63	$ 199.61	$ 397.86	$ 336.13	$ 330.08	$ 324.30	$ 318.76	$ 313.46	$ 308.38	$ 303.51	$ 304.98	$ 294.32	$ 290.00	$ 285.83	$ 281.82	$ 277.95	$ 274.22	$ 270.62	$ 267.14	$ 263.78	$ 335.57	
	Annual Impact to Rate Payer (Monthly)		$ 16.80	$ 16.63	$ 33.16	$ 28.01	$ 27.51	$ 27.02	$ 26.56	$ 26.12	$ 25.70	$ 25.29	$ 25.42	$ 24.53	$ 24.17	$ 23.82	$ 23.48	$ 23.16	$ 22.85	$ 22.55	$ 22.26	$ 21.98	$ 27.96	
	NPV	**$13,347,912**																						

Appendix D
Water Assessment Memorandum

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Technical Memorandum

To: Adam Denlinger, Seal Rock Water District

From: Adam Sussman, GSI Water Solutions, Inc.
Suzanne de Szoeke, GSI Water Solutions, Inc.

Date: March 5, 2015

Re: Source Water Assessment of Source Water Options for Seal Rock Water District

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1. Introduction

GSI Water Solutions Inc. (GSI) developed this memorandum to provide a source water assessment for the watersheds of the four potential sources of supply being considered by the Seal Rock Water District: Henderson Creek, Thiel Creek, Beaver Creek, and Drift Creek. This memorandum is intended to provide a general awareness of land uses (based on zoning and land ownership) in the four watersheds and the associated potential sources of water contamination, as well as to set the stage for a thorough Source Water Protection Plan for the selected water source, if desired. It should also be noted that watershed management practices, such as stream set-backs for agricultural and forest harvest operations, and planting in riparian areas, can improve water quality.

2. Approach

This memorandum presents zoning and tax lot ownership information for lands within each watershed and the typical contaminants associated with the identified land uses. GSI collected zoning information from the Lincoln County Department of Planning and Development Web page titled Zoning Map Index (http://www.co.lincoln.or.us/planning/zoning.html) and land ownership information from the Lincoln County Assessors Web page titled Linking County Assessors Maps (http://www.co.lincoln.or.us/assessor/maps.html). In addition, GSI used information from the Oregon Department of Environmental Quality's Drinking Water Source Protection Web page titled Typical Contaminants from Land Uses/Sources (http://www.deq.state.or.us/wq/dwp/docs/typcontaminants.pdf) to describe potential types of contaminants that may be present as a result of land uses occurring in the four watersheds.

3. Zoning and Land Ownership

Assessing the uses of land within a watershed provides an initial step for assessing possible sources of water contamination in a watershed. Zoning and land ownership information provides good information about existing and potential land use activities occurring within the watershed. Land use zoning clarifies the uses allowed on the land. Tax lot ownership elucidates who actually owns the land and the types of activities the owner may engage in, such as timber harvesting by a timber company. The following summary describes the zoning and tax lot ownership of the lands within the watersheds of the four source water options being considered by the Seal Rock Water District.

Henderson Creek

Land uses along the majority of Henderson Creek appear to be primarily municipal/residential purposes. The primary use in its headwaters is timber purposes.

The lands through which Henderson Creek flows near the potential point of diversion are zoned "City" and "Residential," except for a small area zoned "Planned Industrial." The remainder of the lands through which Henderson Creek flows are zoned "Timber Conservation." The tax lots through which the creek flows are owned by the City of Newport, an individual, a developer, an investment company, and a timber company. Tax lots in the watershed uplands are largely owned by timber companies, and these tax lots are zoned "Timber Conservation." In addition, land application of solid waste by the City of Newport occurs adjacent to Henderson Creek and an airport is located close to Henderson Creek.

Thiel Creek

Land uses in the Thiel Creek watershed appear to be primarily municipal and timber purposes.

The lands through which Thiel Creek flows are zoned "City" near the potential point of diversion and the remaining lands are zoned "Timber Conservation." The uplands in the watershed are similarly zoned, and also include a "Rural Residential" zoning near the potential point of diversion. The tax lots through which the creek flows are owned by a steel company near the point of diversion, but it appears that no industrial use is currently occurring on this land (based on aerial images on Google maps), and the remaining tax lots are owned by timber companies, the Bureau of Land Management, and several individuals, including one landowner practicing small-scale agriculture.

Beaver Creek

Land uses in the Beaver Creek watershed appear to be primarily agriculture along Beaver Creek, timber purposes in the uplands, and conservation purposes near the potential point of diversion. The headwaters of Beaver Creek are owned by the U.S. Forest Service, which manages its forest lands for uses including timber harvesting, fish and wildlife conservation, and recreation. Historically, the Forest Service's management focus for federal forests has changed over time.

The lands through which Beaver Creek flows at the potential points of diversion and upstream to the mouth of North Fork Beaver Creek are zoned "Agricultural Conservation." Beyond that point, the lands through which North Fork Beaver Creek flow are zoned "Agricultural Conservation" and the headwaters of Beaver Creek are zoned "Timber Conservation." Uplands in the watershed adjacent to the lands zoned "Agricultural Conservation" are zoned "Timber Conservation." The tax lots at the potential points of diversion and along the majority of Beaver Creek's course are owned by individuals with small timberland tracts and small-scale agriculture. The tax lots just upstream of the potential points of diversion are owned by the State of Department of Parks and Recreation. Other tax lots in the Beaver Creek watershed are owned by the U.S. Forest Service (as part of the Siuslaw National Forest), timber companies, and a few private landowners.

Drift Creek

Land uses in the Drift Creek watershed appear to be primarily small-scale agriculture, timber harvesting, and potentially a combination of uses, which could include timber harvesting, fish and wildlife conservation, and recreation, on U.S. Forest Service lands.

The lands through which Drift Creek flows are zoned "Agricultural Conservation" and "Timber Conservation" near the potential points of diversion, and "Timber Conservation" further upstream. The watershed uplands are zoned "Timber Conservation." The tax lots immediately upstream of the potential points of diversion are owned by a company conducting small-scale farming and managing forest land, and the tax lots in the mid-watershed, as well as the uplands from the points of diversion through the mid-watershed, are owned by the U.S. Forest Service as part of the Siuslaw National Forest. The tax lots in the headwaters of Drift Creek are primarily owned by a timber company.

4. Typical Contaminants

The primary land uses identified in this memorandum fall within agriculture (including rural homesteads), forestry, and municipal uses. This memorandum did not attempt to determine the exact types of agriculture, forestry practices, and municipal uses occurring in the watersheds and their related contaminants. Instead, the following is a summary of the types of contamination that typically occur as a result of these types of land uses, based on information from the Oregon Department of Environmental Quality.

Agriculture

- Irrigated and non-irrigated crops: pesticides, fertilizers, nitrates, phosphates, potassium
- Dairies, chicken, turkeys: nitrates, total dissolved solids, salts, phosphates, potassium
- Rural homesteads:
    - Machine shop related wastes, including: automotive wastes, welding wastes, solvents, metals, lubricants, and sludges

  - Septic system related wastes, including: coliform and non-coliform bacteria, viruses, nitrates, heavy metals, synthetic detergents, cooking, and motor oils, bleach, pesticides, and paints

Managed Forest Lands: sediments, pesticides, fertilizers, petroleum (spills)

Municipal

- Airports: jet fuels, de-icers, diesel fuel, chlorinated solvents, automotive wastes, heating oil, and building wastes
- Septic system wastes (described above)
- Housing
  - Household hazardous wastes, including: various household cleaners and solvents, paints, and pesticides
  - Mechanical Repair and Other Maintenance Products, including: automotive wastes, fuels, grease, and car wash detergents
  - Lawn/garden care, including: fertilizers, herbicides, and other pesticides
  - Urban runoff/stormwater: gasoline, oil and other petroleum products, and microbiological contaminants
- Wastewater: municipal wastewater, sludge, treatment chemicals, nitrates, heavy metals, coliform and non-coliform bacteria, and nonhazardous wastes

In addition, one area in the Henderson Creek watershed was zoned Planned Industrial. The contaminants typical of the planned industrial operation will depend upon the specific industrial operation/process that ultimately occurs at the location.

5. Conclusion

The reconnaissance level analyses of land use zoning and land ownership described above revealed no major, identifiable threats to the four potential water supply sources that would preclude conducting further investigation into their use. The land uses in the Henderson Creek and Thiel Creek watersheds are predominantly municipal and timber purposes, while land uses in the Beaver Creek and Drift Creek watersheds are predominantly timber and agricultural purposes, as well as multi-use on U.S. Forest Service lands. Agricultural, forestry, and municipal activities may affect water quality in these creeks by potentially contributing typical contaminants resulting from these activities, such as those described in this memo. The appropriation and treatment systems proposed are, however, anticipated to deal with such contaminants.

Appendix E
Draft Criteria Evaluation of Water Supply Options

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Draft Criteria Evaluation of Water Supply Options 2/12/2015

Criteria	Henderson Creek	Thiel Creek	Beaver Creek	Drift Creek
Water Quality	Treated water quality is expected to be comparable to the District's current treated water. Specific source water quality concerns due to location (Highway 101; treated sewage disposal).	Treated water quality is expected to be comparable to the District's current treated water. No specific source water quality concerns.	Treated water quality is expected to be comparable to the District's current treated water. No specific source water quality concerns.	Treated water quality is expected to be comparable to the District's current treated water. No specific source water quality concerns.
	2	4	4	4
Supply Sufficiency (x2)	Limited supply due to low stream flow. Future ADD available November--May; Future MDD available only Dec.--March	Limited supply due to low stream flow. Future ADD available year-round, future MDD available November--June.	No supply limitation. Future ADD & MDD available year-round.	Supply limited due to water right restrictions. Future ADD & MDD available December--September.
	0	2	4	0
Resiliency/Risk Analysis	High risk associated with manmade threats; possible damage associated with natural disasters	Low risk associated with manmade threats; risk associated with floods and tsunamis	Moderate risk associated with manmade threats; risk associated with floods and tsunamis	Low risk associated with manmade threats; risk associated with floods and tsunamis, risk associated with landslides and power outages, risk of transmission line breaks
	1	3	2	1
Environmental Impacts	No ESA-listed fish, some small wetlands impacted	ODFW has concerns about ESA-listed fish. Likely impacts to wetlands.	ESA-listed fish present but local ODFW staff does not expect impacts, impacts to wetlands expected, possible complications due to state natural area, and ongoing mitigation and restoration efforts.	Local ODFW staff has concerns about ESA-listed fish, extensive pipelines expected to cause environmental impacts, and complications possible due to ongoing restoration efforts by U.S. Forest Service.
	3	1	3	1
Construction costs (x 2)	$ 4,676,870 (lowest cost)	$5,438,980 (16% higher)	$6,693,920 (43% higher)	$16,131,844 ($245% higher)
	3	3	2	0
Operations and Maintenance Costs (annual)	$325,915	$399,793	$399,793	$399,793
	4	3	3	3
Regulatory Complexity	New water right not required. No ESA-listed fish. Potential permitting required due to impacts to wetlands, which may require mitigation.	New water right required. Local ODFW staff has concerns about ESA-listed fish habitat. Likely permitting required based on impacts to wetlands, which may require mitigation.	New water right required and high public interest in Beaver Creek. ESA-listed fish present but local ODFW staff does not expect impacts. Likely permitting required due to impacts to wetlands, which may require mitigation.	New water right required. Water supply limited due to water right restrictions. Local ODFW staff has concerns about ESA-listed fish and the instream water rights. Potential extensive permitting associated with transmission line. Potential permitting associated with instream impacts.
	4	2	3	1
Totals	20	23	27	10

4 = source(s) most likely/best suited to meet criteria
0/1 = source(s) unable/least likely to meet criteria