

**CITY OF LINCOLN CITY
CITY COUNCIL
WORK SESSION MEETING AGENDA**

MAY 14, 2024 5:00 PM

5:00 PM - The City Council will hold a Work Session in the Council Chambers, 801 SW Highway 101 - 3rd Floor, Lincoln City, OR 97367.

The meeting location is accessible to persons with disabilities. A request for an interpreter for the hearing impaired, for a hearing-impaired device, or for other accommodations for persons with disabilities, should be made at least 48 hours in advance of the meeting. To request information in an alternate format or other assistance, please contact the City's ADA Coordinator, Kevin Mattias, at [541-996-1013](tel:541-996-1013) or kmattias@lincolncity.org. Visit the [ADA Accessibility | City of Lincoln City, OR](#) webpage to view how the City continues to remain in compliance with Title II of the Americans with Disabilities Act regarding City programs, services, processes, and facilities.

This meeting is a **work session only** and generally does not include public comment.

- 1. CALL TO ORDER**
- 2. DISCUSSION ITEMS**
 - A. 44th to 47th Connector Roadway Project
 - B. Wastewater Feasibility Study
 - C. 17th Street Restroom Project
- 3. MISCELLANEOUS**
- 4. ADJOURNMENT**

Council Communication

44th to 47th Connector Roadway Project

Meeting Date:	May 14, 2024	Primary Staff Contact:	Daphnee Legarza
Department:	City Council	E-Mail:	DLegarza@lincolncity.org
Secondary Dept:		Secondary Contacts:	
Approval:	Daphnee Legarza	Estimated Time:	30 minutes

Project Description

The project includes constructing a new road connecting NE Logan Road with NW 44th and NE 47th Streets. The project is identified in the City's 2015 Transportation System Plan and it will provide greater transportation route choice for all modes, including improved emergency evacuation routes. The project is also identified in the Roads End / Villages at Cascade Head Urban Renewal Plan, which allows for the expenditure through a contract or Intergovernmental Agreement (IGA) between the City and Agency.

Background

On June 12, 2023 at a Joint Meeting of the City Council and Urban Renewal Agency, a design contract was awarded to Akana for Phase I design and engineering of the 44th - 47th Street Connector Road. The Roads End/Villages at Cascade Head Urban Renewal Plan provided budget for the Phase I concept design of the project. Prior to bid award, and on behalf of the Agency, the City's Public Works Department advertised and received four proposals. The proposals were reviewed by both the City Staff and Confederated Tribes of Siletz Indians and Akana was recommended for bid award.

The design and construction services for the project is estimated by Akana at \$518,000.00. The budget available at time of award was \$100,000. Staff has negotiated with Akana to conduct preliminary engineering work to develop two concept plans for review, take the project through a public review, and select a concept plan for Phase 1 at a cost of \$99,998.00. Phase 2 work would continue if further budget was approved.

As the contract work progressed, two scenarios were explored: 1) a least-impact road placement to connect the two roads; and 2) a bridge concept. The bridge concept was determined to be infeasible because the span distance (relatively short) would result in an extreme slope unsafe for a road (80' elevation difference between each side of the road connection).

Project Update

In February, the Confederated Tribes of Siletz Indians moved to proceed with the design

work. Now that a design concept has been determined, Phase 2 can proceed.

Financial Considerations:

This project was funded from the Street Capital Fund transferred in FY23-24 from the Urban Renewal Agency's Roads End / Villages at Cascade Head fund (\$100,000 budgeted; \$99,988 transferred from Agency to City via IGA). Some funds remain from the Phase I contract. FY24-25 budgets have proposed funding (\$359,557 in URA budget; \$400,000 in City budget) for Phase 2 of the design and engineering work now that an alignment and design approach have been determined. If approved, once that work is complete the Agency will reimburse the City. Construction funding has yet to be determined.

Attachment:

Basis of Design Report December 20, 2023

Attachments:

Basis of Design Report_2023-12-20 (PDF)

BASIS OF DESIGN

**NE 44th – 47th CONNECTOR
Lincoln City, Oregon**

Akana Project Number 23-017

December 20, 2023



Prepared For:

City of Lincoln City

**Public Works Department
801 SW Highway 101
Lincoln City, Oregon 97367**

Prepared By:



**6400 SE Lake Road, Suite 270
Portland, Oregon 97222**

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1.0 INTRODUCTION

The NE 44th – 47th Connector Project plans a new road to extend NE 47th Street to the intersection of NW 44th Street and NW Logan, traversing a forested ravine owned by the Confederated Tribes of Siletz Indians (CTSI). This connector road has the potential to redirect traffic onto Logan Road which is currently routed to a congested section of Highway 101, to provide a new tsunami evacuation route, and to provide a direct road connection between CTSI’s Chinook Winds Casino and Hotel and the Chinook Winds Golf Resort, located approximately 0.75 miles to the east. The proposed connector road would also provide pedestrian and bicycle connectivity to an underserved area of the city, in accordance with the city’s long term transportation plans.

This project is funded by the City of Lincoln City Department of Urban Renewal & Economic Development. Lincoln City contracted with Akana on June 22, 2023, to provide professional design services in developing two conceptual design options to be considered by the City and CTSI.

Akana has prepared and assessed two conceptual design options, estimated construction costs, and evaluated alternative methods of construction that might be used to connect the two roads. As part of this preliminary design effort, the potential wetland and cultural resource impacts on the project site have been investigated and a preliminary geotechnical reconnaissance of the site has been undertaken. The conceptual designs, cost estimates, geotechnical reconnaissance summary, cultural resources investigation report, and wetland investigation are shown in Appendix A, B, C, D, and E, respectively.

The purpose of this Basis of Design Report is to document the commitments and requirements that will guide the design effort, providing the City of Lincoln City and CTSI with the technical information needed to assess the feasibility of the project and make informed decisions going forward.



2.0 BASE MAPPING AND EVALUATION OF EXISTING CONDITIONS

Base mapping for the project was developed using information provided by the City, supplemented by field data collected as part of the wetland and cultural resources investigations, as well as utility verification measurements taken in the field during site visits.

Property boundaries, easements, and initial utility locations were developed using information provided by the City of Lincoln City Geographic Information System (GIS). As-Built drawings showing the existing water, sanitary sewer and storm drainage improvements surrounding the project were provided by the City. This information was compared to the information shown in the GIS data and some revisions were made to the base map based on the as-builts. In some instances, contradictory information regarding the utility connections was discovered and a visit was made to the site to verify and measure the actual utility locations. However, the existing storm drainage in the area south of the CTSI’s Logan Road RV Park is inadequately represented by the City’s GIS data, as no as-built drawings of this area were provided to the City and extensive growth of blackberries on the site prevented observation of the full storm system in the field.

Due to the heavy forest covering the site, a site topographic survey was not performed for the conceptual design. Existing ground contours for the site were developed using Light Detection and Ranging (LIDAR) data provided by the City. Heavy tree cover of the site can decrease the accuracy of the existing ground mapping, but based on our examination of the site, we found that the City LIDAR data produced a reasonably good representation of the site topography, more than sufficient for conceptual design.

Data also shows that the proposed roadway will cross one main creek and two minor creeks that lead to an existing 24-inch culvert located on the southeastern part of the site. Wetland limits shown on the drawings are based the wetland field delineation, located using GPS data collectors.

The LIDAR and GIS data, utility as-built drawings, and information collected in the field were combined to depict Akana’s best understanding of the existing conditions of the project using AutoCAD Civil 3D v2018. This mapping should be considered approximate and topographic surveying will be required for any design efforts undertaken in the future.

We understand that the CTSI seeks to develop the tribally owned property south of the Logan Road RV Park. Based on available recorded information and our present understanding of the site, it appears that the development potential of this area will be constrained by the presence of existing underground utility pipes and easements in this area. Permanent structures are typically prohibited over existing utilities and easements. Akana suggests a closed-circuit television (CCTV) inspection be conducted to precisely trace the location of the existing storm and sanitary sewer mains and determine whether relocation of these mains may be required to maximize the areas available for development.



3.0 DESIGN BASIS

3.1 ROAD CLASSIFICATION

Based on the City’s 2015 Transportation Plan prepared by DKS Associates, the road classification for this project has already been assigned as a Medium-Use Collector. A collector is required to have a minimum of 12-foot travel lanes, 5–6-foot sidewalks, 5–6-foot bike lanes, and a minimum of 55-foot ROW as cited in the City’s 2022 Public Works Design Standards.

In order to meet the particular needs of this project, where significant fills are expected, and to decrease the width of the road prism in order to reduce the grading impacts on the tribally owned parcel, modifications to the City standard road section for this project were discussed and agreed upon for the conceptual design. Travel lanes were reduced to 11-feet as a traffic calming measure, landscaping strips and parking were eliminated, an 8’ sidewalk was placed on one side of the road and an 8’ bike lane on the other side of the road. Guardrails were shown for portions of the road where walls were proposed.

Typical roadway sections are shown on Sheet 2 of Appendix A.

3.2 HORIZONTAL AND VERTICAL ALIGNMENT

Design speeds of 25 mph were used in the basis of this design.

Horizontal alignments were designed in accordance with the City Design Standards, including the use of a 200-foot minimum horizontal radius for the roadway centerline and a 25-foot curb return radius for intersections with collector roads.

Vertical alignments were designed in accordance with the 2022 City of Lincoln City Public Works Design Standards. The City Design Standards allow a maximum slope of 15 percent for lengths not exceeding 150-feet.

Crest vertical curves were based on the stopping sight distance requirements of the American Association of State Highway and Transportation Officials (AASHTO) geometric design standards, based on a design speed of 25-mph. The minimum required rate of vertical curvature (K) for design is 12. Actual K values used for this conceptual design vary from 12.11 to 13.12.

Sag vertical curves were based on the comfort design contained in the AASHTO geometric design standards. Site topographic constraints did not allow the use of vertical curves based on the stopping sight distance, which would be approximately twice as long. To meet stopping sight distance, illumination on the proposed road is required. The minimum K value for sag vertical curve based on comfort design speed is given by the formula



$K = V^2 / 46.5$, where V is the design speed in mph.

Using a 25-mph design speed, the required minimum K value is 13.44. Actual K values used for this conceptual design vary from 13.48 to 13.52.

3.3 CULVERT SIZING

The proposed connector road will cross three existing creeks. Akana used the StreamStats program, a spatial analytical tool published by the United States Geologic Survey, to delineate drainage areas, get basin characteristics and estimate the peak flows used for culvert sizing.

A 24-inch culvert was selected to convey the 25-year peak flow of 15.5 cubic feet per second along the mainstream channel traversing the site. The proposed culvert sizing is consistent with the existing culvert located downstream of the proposed road crossing, which is also 24 inches.

A side channel crosses the proposed road near its connection to NE 47th Street at the east end of the project. It appears that a 12-inch culvert will adequately convey the 25-year peak flow in this side channel. However, this culvert was upsized to 18 inches to reduce maintenance that may be required due to the accumulation of woody debris in this forested setting.

During Akana’s site visit, an existing steel 18-inch culvert was discovered near the west end of the proposed roadway. Because the existing culvert ends within the interior of the proposed road, a new pipe is proposed to extend this storm sewer to the downstream toe of the roadway embankment. The culvert extension will utilize an 18-inch culvert in size to match the existing culvert dimension.

3.4 ALTERNATIVE ANALYSIS

Akana developed two horizontal alignment alternatives, a T-intersection, and an S-curve. T-intersection alternative would continue the centerline alignment entering the RV park and move east that utilizes a transition of 200-foot radius concaving west and a 200-foot radius concaving east to match onto NE 47th Street. S-curve alternative would start on the intersection between NW 44th Street and NW Logan Road and proceed east while staying in parallel with the properties southern ROW. This alternative will then create an S-like shape composed of a 350-foot radius concaving west and transition to a 200-foot radius concaving east and match NE 47th centerline. T-intersection and S-curve horizontal alignments are shown in Figures 1 and 2.



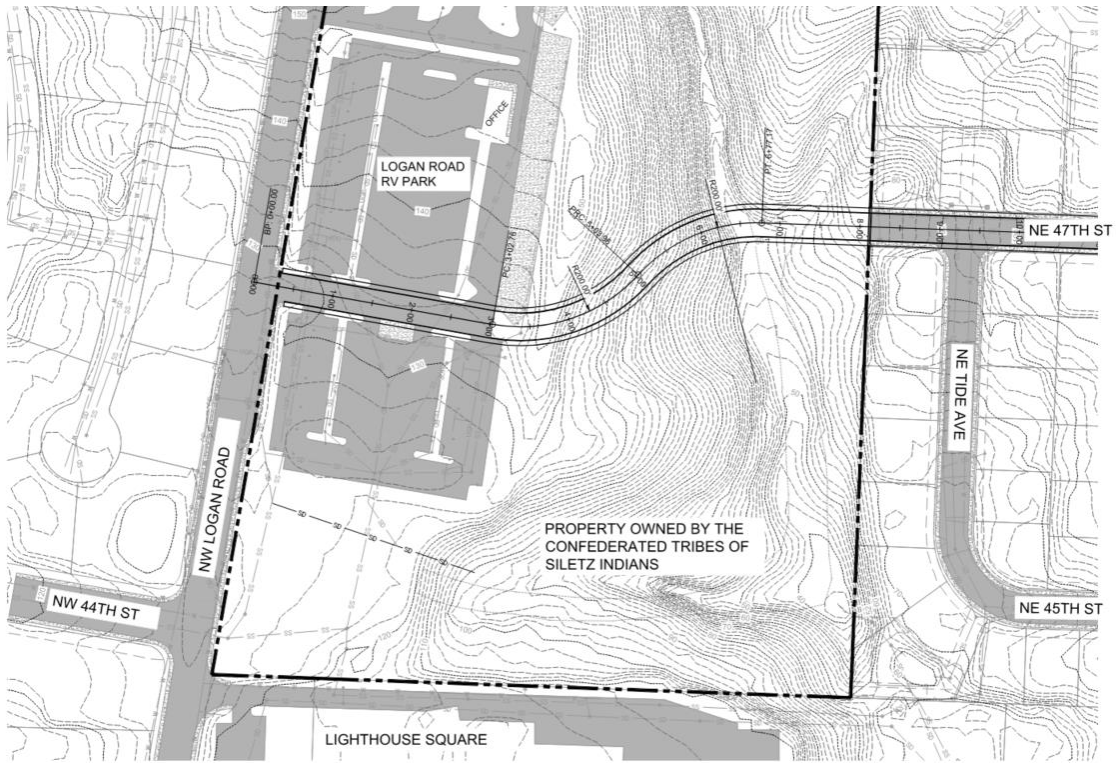


FIGURE 1
T-INTERSECTION ALTERNATIVE

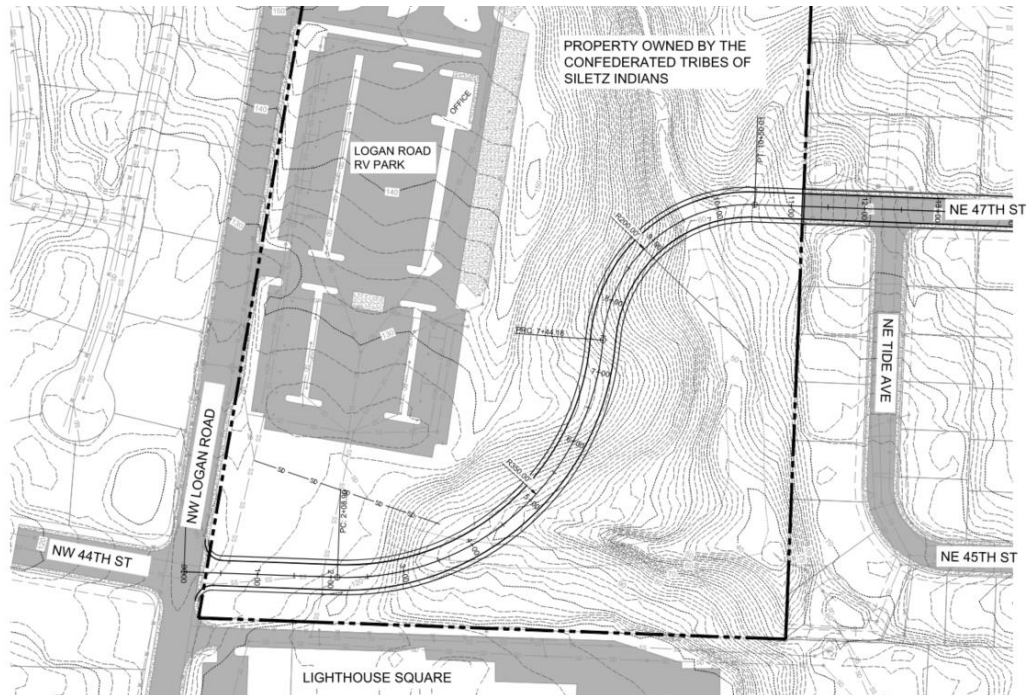


FIGURE 2
S-CURVE ALTERNATIVE



Akana evaluated the feasibility of the T-intersection scenario and determined that this alternative was not feasible. To meet crest and sag vertical curve requirements, this alternative would require that construction extend well into the RV Park and beyond the intersection of NE 47th Street and NE Tide Avenue. Akana suggested this alternative be eliminated due to the impact on existing properties. On August 22, 2023, the two horizontal alignment alternatives were presented to the City and CTSI and it was agreed that the T-intersection alternative would be eliminated from further consideration.

Akana also developed two grading alternatives to determine the potential area of impact on the site. Alternative 1 uses a conventional road prism with 2:1 side slopes to daylight, for both cut and fill conditions. Alternative 2 would incorporate a combination of 2:1 side slopes and retaining walls to reduce the grading disturbance on the heavily forested site. Retaining walls would be placed along the single long cut slope and at locations where fill slopes exceed 10-feet. Mechanically stabilized earth (MSE) walls are proposed along fill slopes, as this style of wall tends to be the lowest-cost wall option. However, Cornforth Consultants recommended installing cast-in-place walls for the cut condition in this geologic setting. Representative wall sections are shown on Sheet 8 of Appendix A. With the elevation difference of the proposed connector road and the bottom of the slope, guardrails and terminals will be required for the safety of road users. Grading alternatives 1 and 2 are shown on Sheets 4 and 5 of Appendix A. The typical roadway sections on which the alternatives are based are shown on Sheet 2 of Appendix A.

4.0 COST ESTIMATES

Construction costs are currently in a period of rapid cost escalation resulting from the lingering effects of the COVID-19 pandemic, and associated supply chain and labor disruptions. Akana developed conceptual budget-level cost estimates for the two grading alternatives, shown in Appendix B.

The costs for tree removal are not included in the cost estimates because the trees to be removed are large enough to have merchantable value and may be logged prior to construction, subject to the approval of CTSI.

Akana is giving Stormwater Quantity and Quality Control Measures an allowance of \$250,000 because the specific method used to provide these controls has not been determined. This cost will affect both alternatives equally.

The cost of wetland/habitat mitigation has not yet been determined, as the method to be used to mitigate wetland impacts has not been determined. Because Grading Alternative 2 will impact a smaller area of the delineated wetlands, it is expected that these mitigation costs will be lower.



5.0 GEOTECHNICAL RECONNAISSANCE

Akana contracted with Cornforth Consulting to perform a literature review of publicly available information, review and conduct a geologic interpretation of the base map, visit the site to perform a geologic reconnaissance, and communicate the results of their review and reconnaissance. The site reconnaissance will be used to identify subsurface exploration locations needed, identify appropriate drilling equipment needed.

The geotechnical reconnaissance was conducted on August 22, 2023. Evidence was found of historic landslides in the area. The risk of landslide is greatest on west-facing slopes. According to Cornforth Consulting, the proposed roadway appears to be feasible, however additional investigations should be undertaken if additional roadway design is to be undertaken.

The geotechnical reconnaissance report is shown in Appendix C.



6.0 CULTURAL RESOURCES INVESTIGATION

Akana contracted with Harris Environmental Group (Harris) to perform a Cultural Resources Survey. In compliance with Section 106 of the National Historic Preservation Act, a pedestrian survey and shovel testing was conducted. Harris prepared a report summarizing the results of the Cultural Resource Survey.

Cultural Resources Survey was conducted on October 7, 2023, and dug 11 holes within the proposed alignment. No cultural or archeological artifacts were found. The cultural resources investigation report is shown in Appendix D.



7.0 WETLAND INVESTIGATION

Akana contracted with Environmental Science & Assessment, LLC (ES&A) to perform a wetland delineation and mapping. ES&A conducted the background mapping review and field data collection on the wetland boundary and flagged wetlands within the proposed connector road alignment for inclusion in the base survey. ES&A mapped the wetland and data plot locations with GPS. Based on the results of the field mapping and data points, a wetland delineation report was prepared for concurrence by the City of Lincoln City and CTSI.

Two wetlands were delineated. Wetland A is located near the western end of the proposed connector road and has an area of 2,232 square feet. Wetland B is located near the eastern end of the proposed connector road and has an area of 7,544 square feet.

Wetlands were only delineated within areas of the site potentially impacted by the proposed connector road. Wetlands may be present on other portions of the site, but these areas would not be affected by the project.

The wetland field investigation was conducted on October 12, 2023. The wetland investigation report is shown in Appendix E.



8.0 PERMITTING ISSUES

As the project site is located on tribal property, it is not subject to city or state jurisdiction. Permits related to the site development will be reviewed and approved under Tribal and federal authority. That being said, the project team has agreed to conform with City of Lincoln City stormwater design standards and to design the roadway in general conformance with the city design standards.

The wetland delineation is currently under review by the State of Oregon, Division of State Lands (DSL) for concurrence with our consultant's findings. Although DSL does not have formal jurisdiction, the agency has a recognized and generally accepted level of technical competence. The US Army Corps of Engineers will have jurisdiction over the project for any future permitting. In our view, there was no risk associated with submittal to DSL, and it may add to the comfort level of the Corps of Engineers in their determination of jurisdiction and permitting. In the event the project is selected for further development, a permit issued by the Corps of Engineers will be required to address the wetland impacts and the manner in which these impacts will be mitigated.

The cultural resources report is subject to the review and approval of the Tribal Historical Preservation Office (THPO) of the Confederated Tribes of Siletz Indians. Tribal approval of the report findings will be needed prior to any construction or land clearing activities.

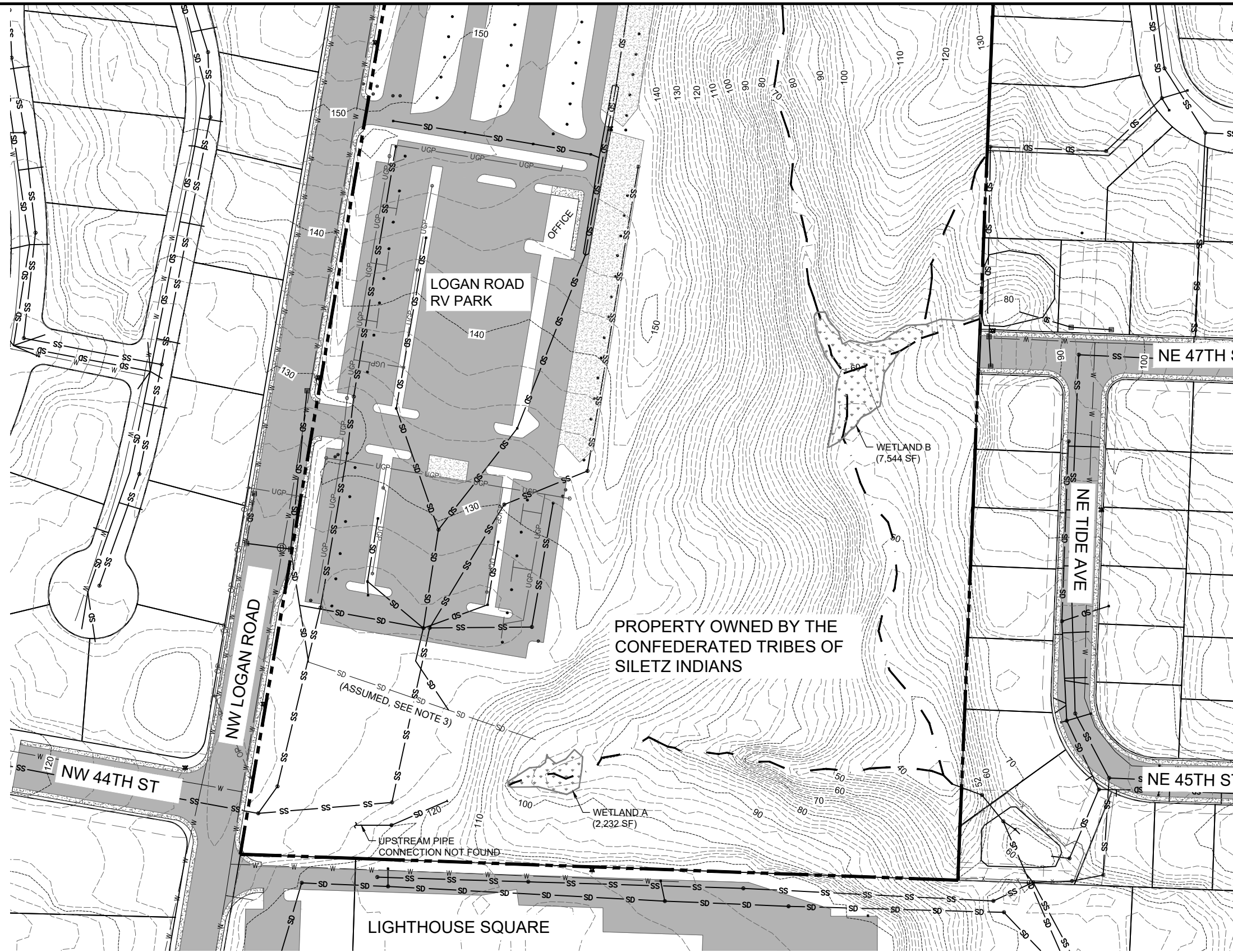
In the event the project is selected for further development, an environmental assessment (EA) of the project conforming to the requirements of the National Environmental Protection Act (NEPA) will be required. It is likely that approval of this EA will need to be obtained prior to any site clearing activities that will be needed to collect information required for the final design, including topographic survey and a final geotechnical investigation.



**APPENDIX A
DRAWINGS**

(8 Sheets)

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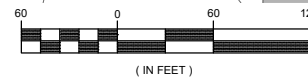
- STORM CATCH BASIN
- ⊙ SANITARY SEWER MANHOLE
- ⊙ SANITARY SEWER CLEANOUT
- ⊙ STORM DRAIN MANHOLE
- ⊗ WATER VALVE
- UTILITY POLE
- ⊙ LIGHT POLE
- ⊗ FIRE HYDRANT
- UGP — UNDERGROUND POWER
- OHP — OVERHEAD POWER
- SD — STORM DRAIN
- SS — SANITARY SEWER
- W — WATER LINE
- x — FENCE
- — — — — PROJECT BOUNDARY
- — — — — TAX LOT
- — — — — DELINEATED WETLAND LIMITS
- — — — — WETLAND LIMITS
- ▨ DELINEATED WETLAND HATCH
- PAVEMENT
- ▨ CONCRETE SIDEWALK

NOTES:

1. EXISTING FEATURES SHOWN ARE BASED ON GIS DATA AND AS-BUILT DRAWINGS PROVIDED BY CITY OF LINCOLN CITY AND SHOULD BE CONSIDERED APPROXIMATE.
2. WETLAND LIMITS DEPICTED HERE WERE DELINEATED IN THE FIELD BY ENVIRONMENTAL SCIENCE AND ASSESSMENT, LLC. WETLANDS WERE ONLY DELINEATED WITHIN AREAS OF THE SITE LIKELY TO BE IMPACTED BY THE PROPOSED CONNECTOR ROAD CONSTRUCTION. WETLANDS MAY BE PRESENT ON OTHER PORTIONS OF THE SITE, BUT THESE AREAS WOULD NOT BE AFFECTED BY THE PROJECT.
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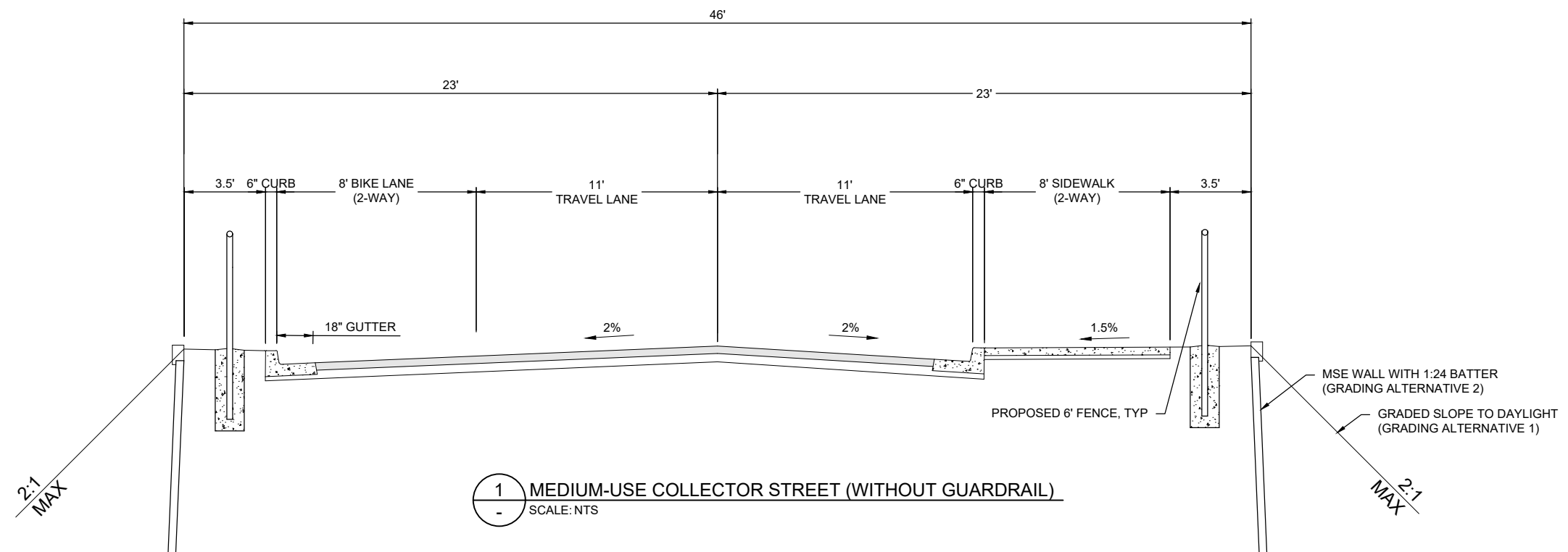
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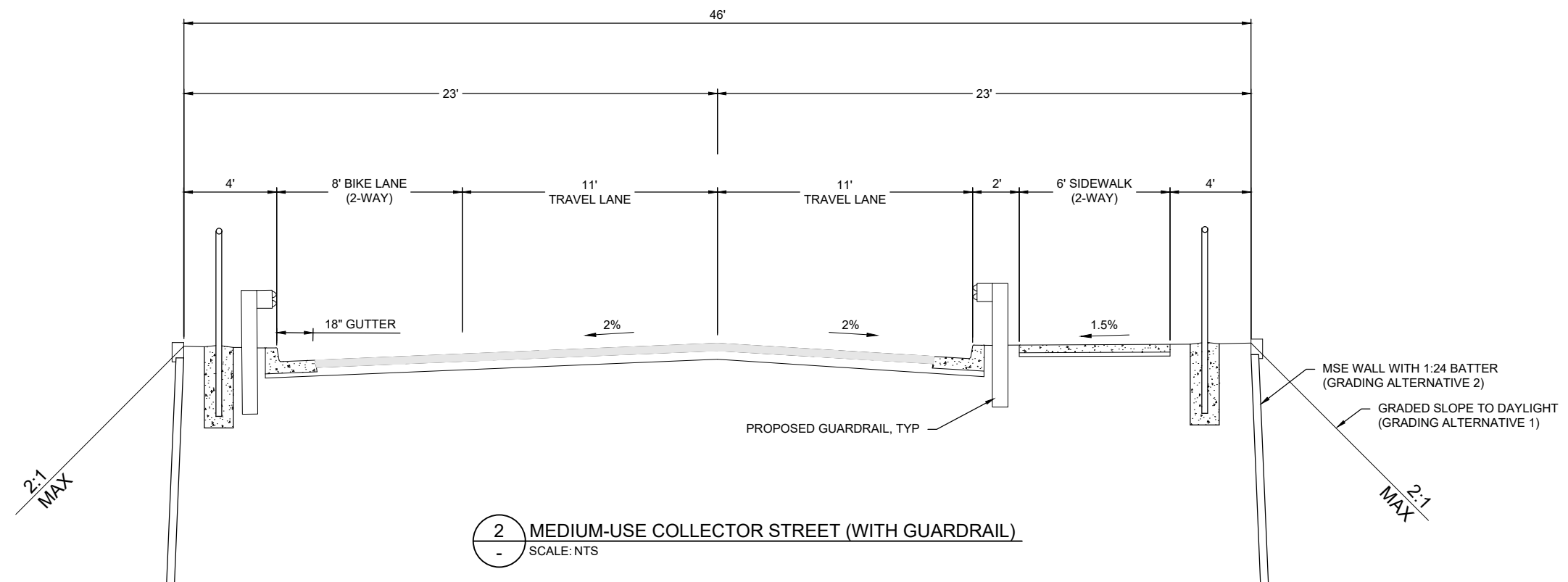
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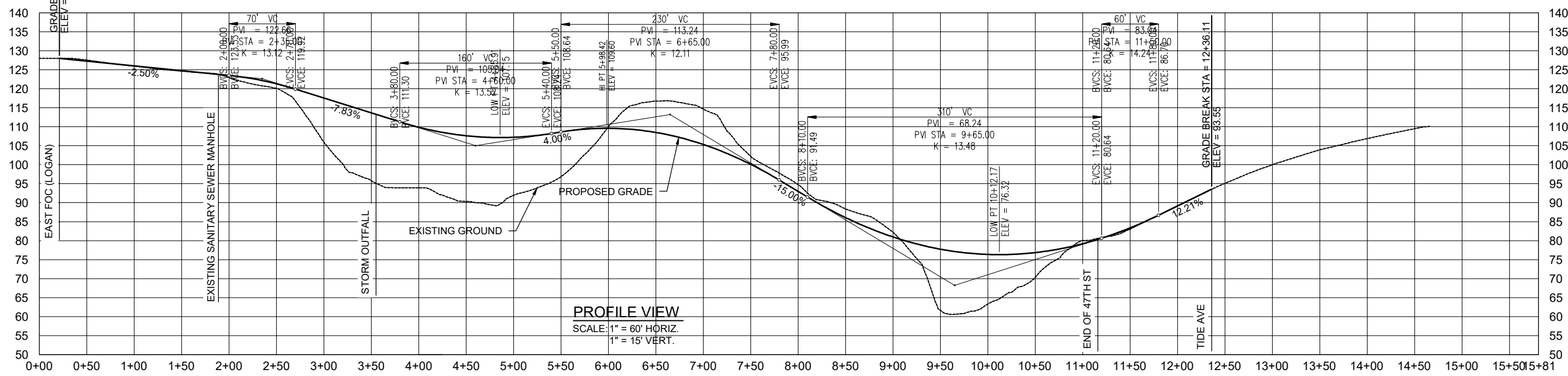
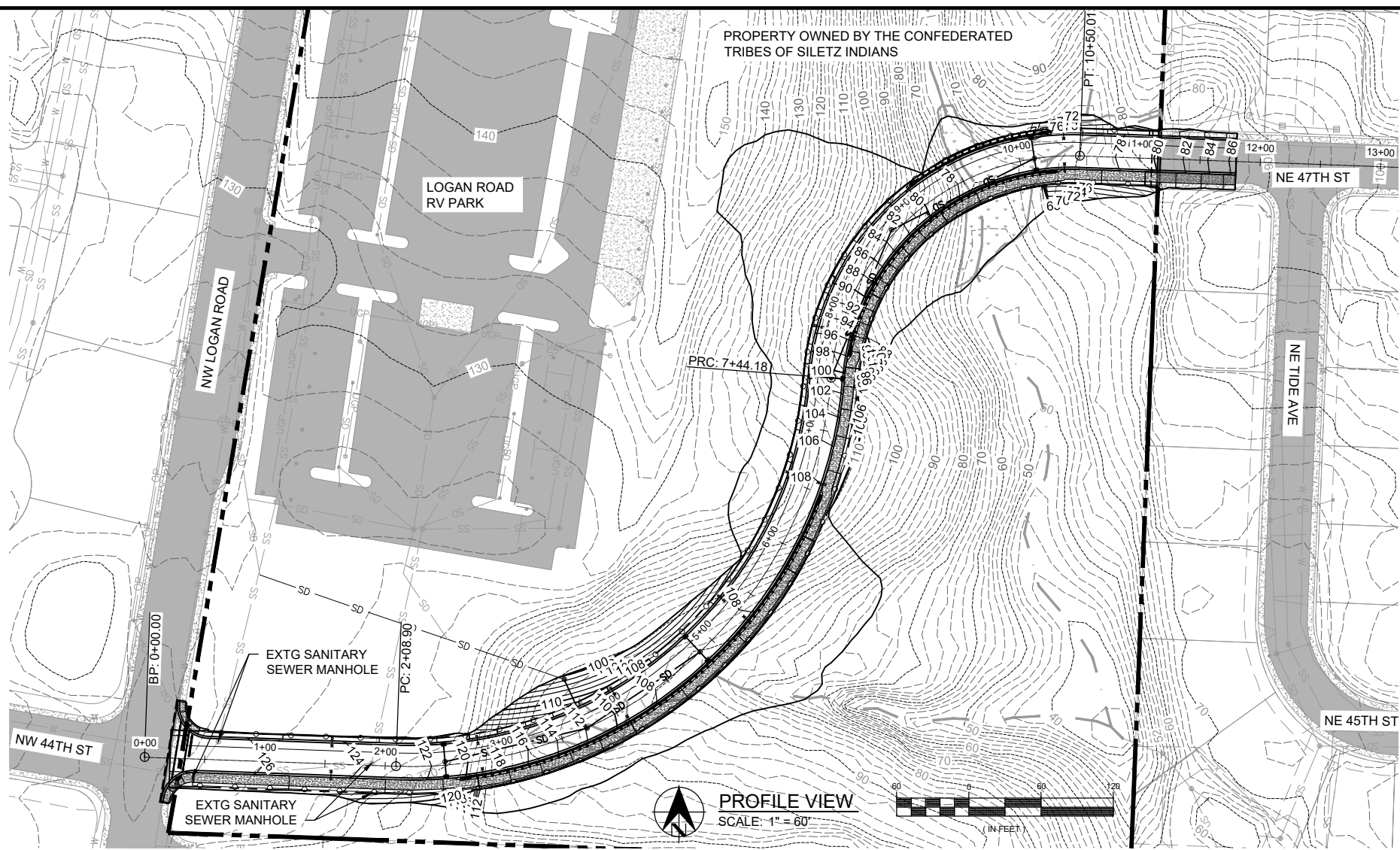
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TYPICAL ROADWAY SECTION

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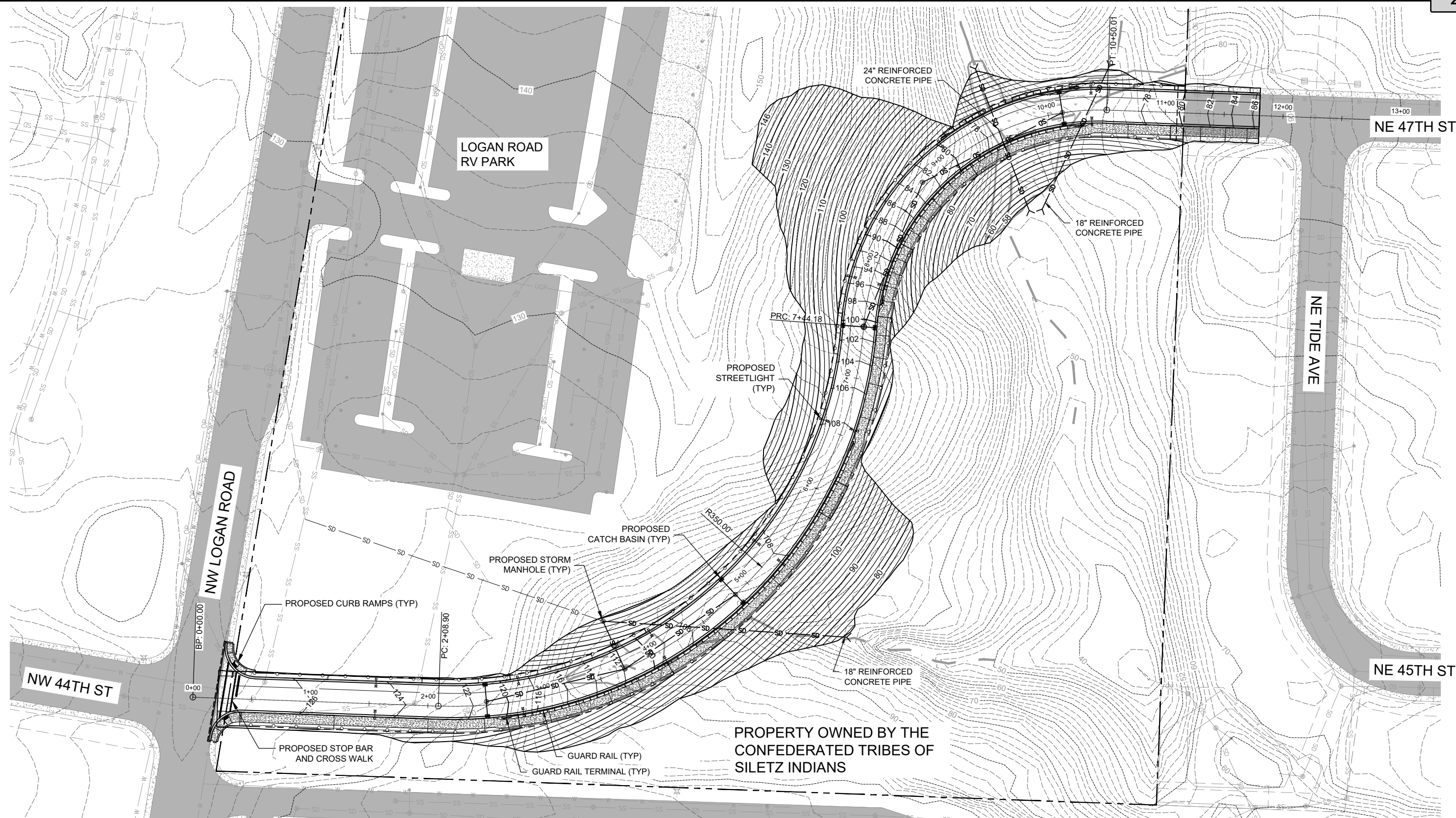
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DESIGN SERVICES

PLAN AND PROFILE

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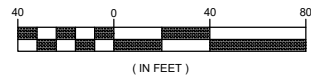
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PLAN VIEW
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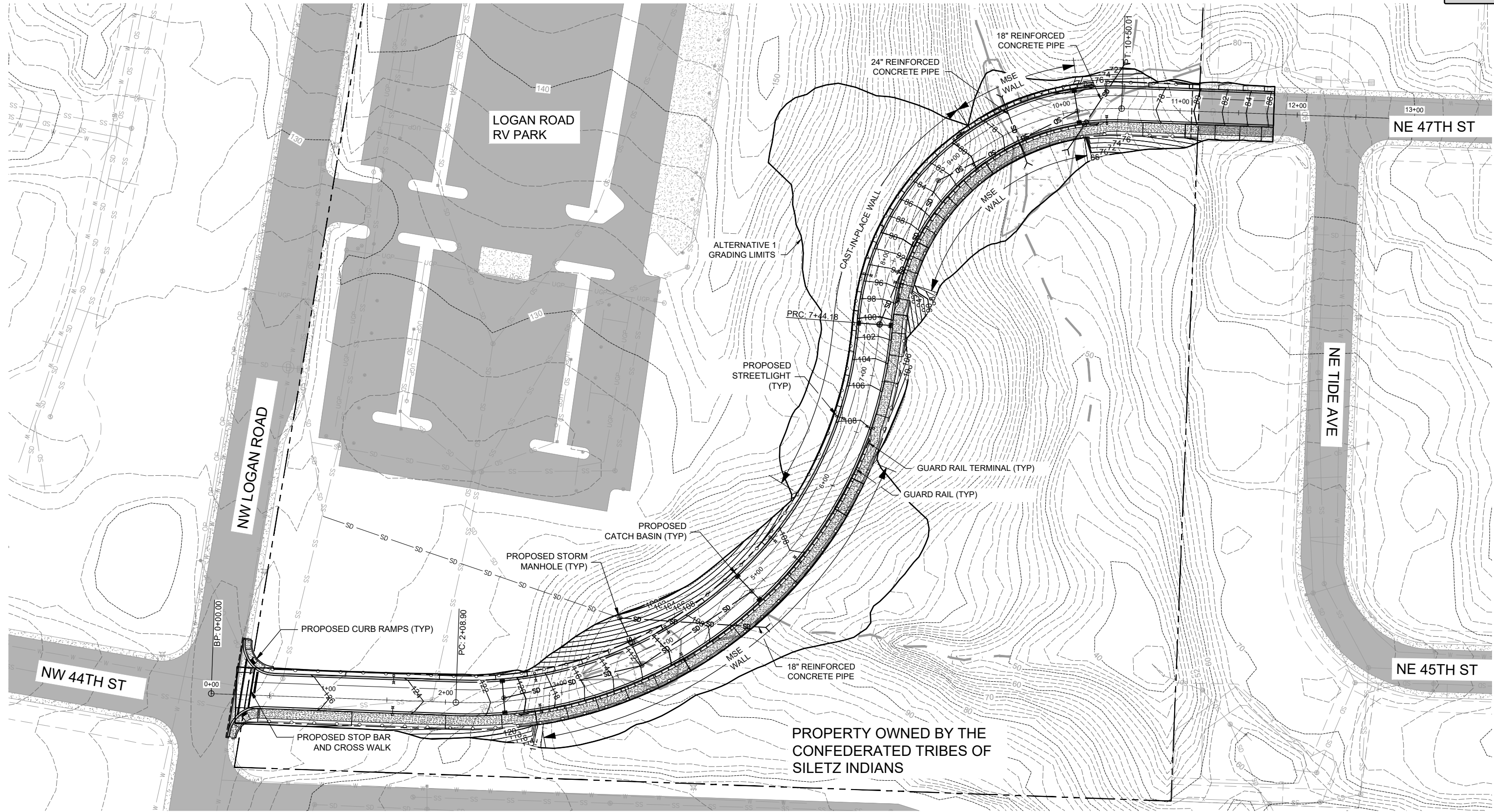
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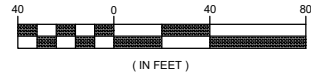
NE 44TH - 47TH CONNECTOR
DESIGN SERVICES

ALTERNATIVE 1
PLAN VIEW

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SHEET NO. 4



PLAN VIEW
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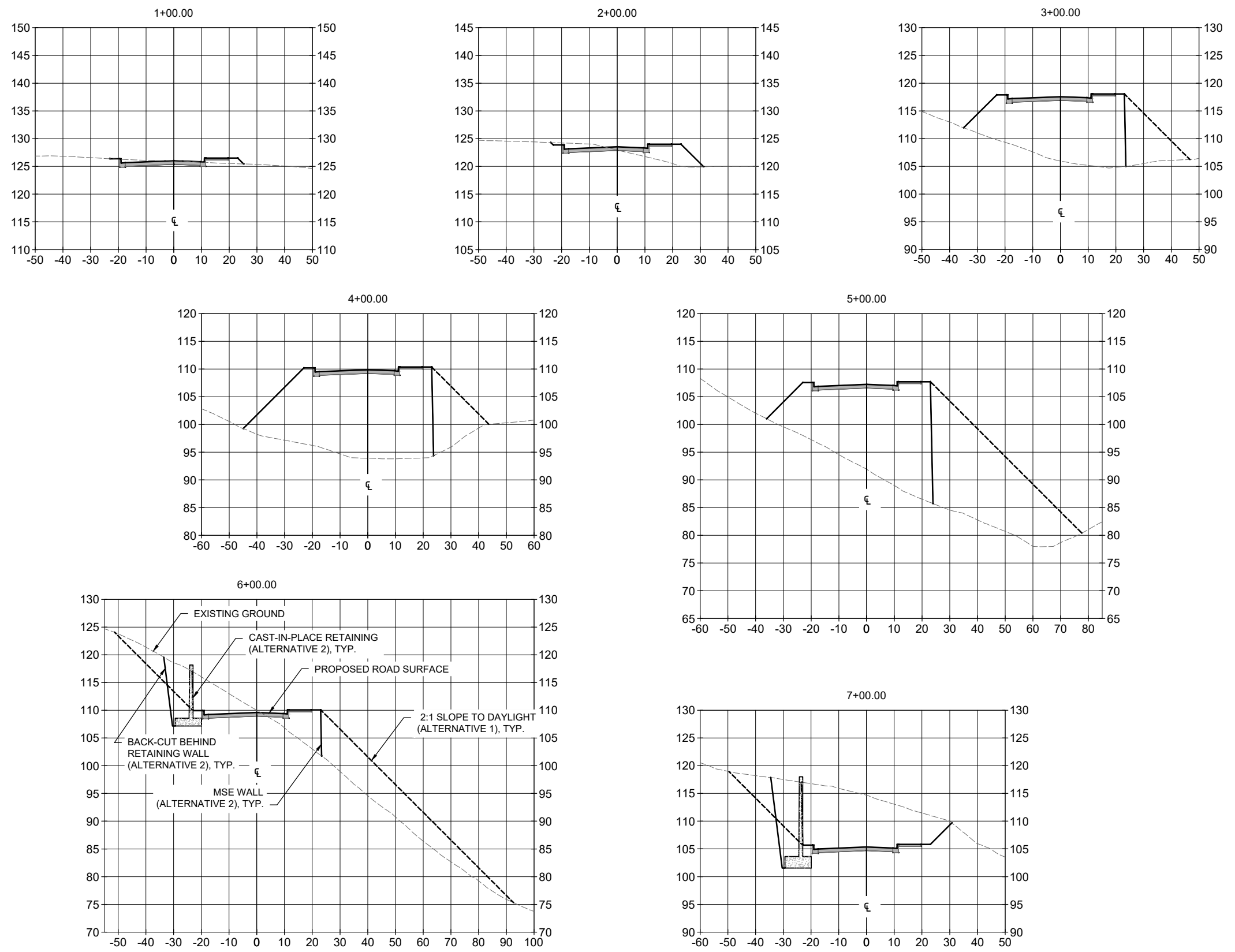
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JOB NO. AK 23-017
SHEET NO. 5



NOTE:
MSE = MECHANICALLY STABILIZED EARTH

CROSS-SECTIONS
SCALE: HORIZONTAL 1" = 20' VERTICAL 1" = 10'

NOT FOR CONSTRUCTION

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AKANA
Plan + Design + Engineer + Manage



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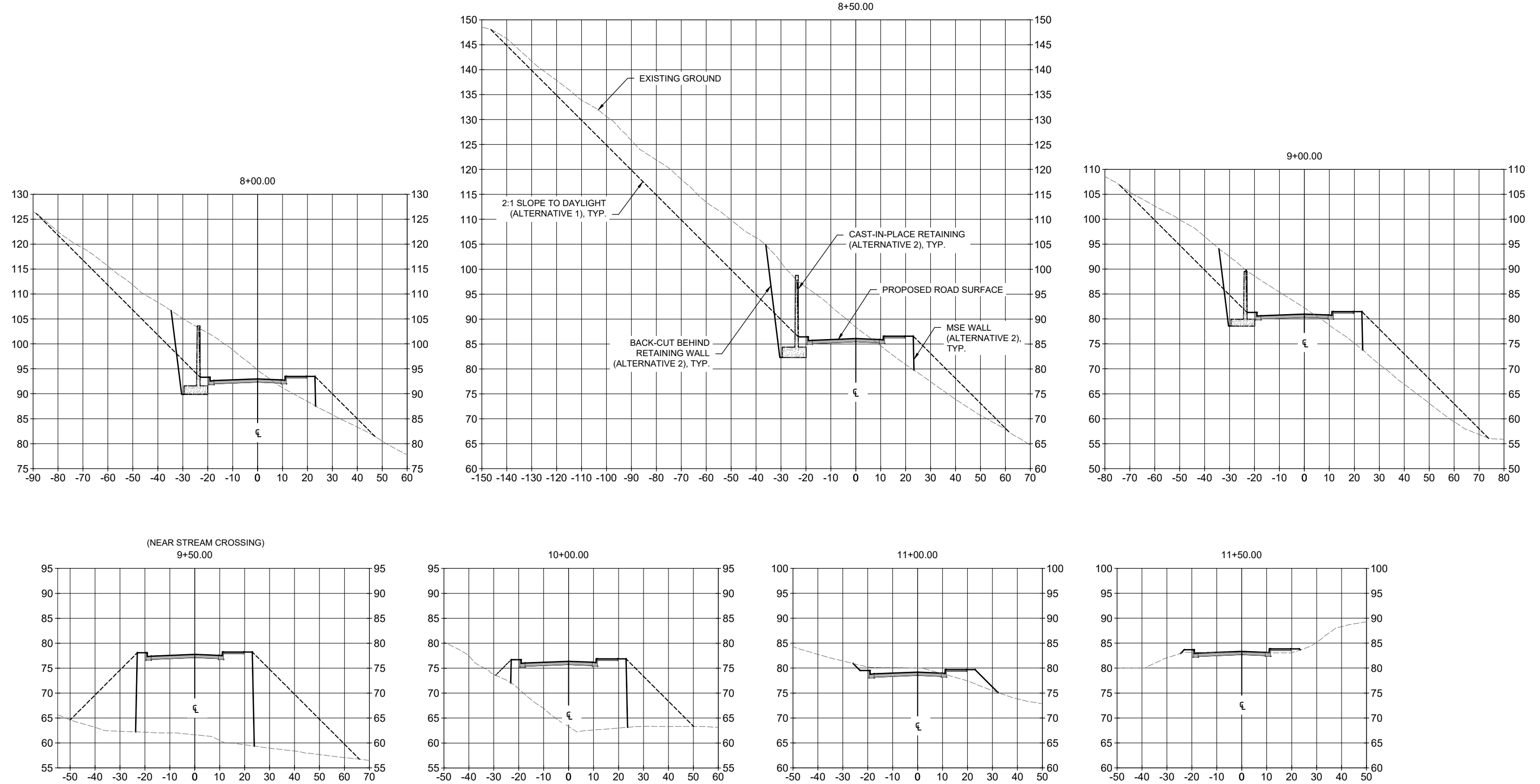
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PUBLIC WORKS DEPARTMENT
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LINCOLN CITY, OR, 97367
TERRY CHAMBERLIN, PE
(541)-996-1292

EGR
DESIGNED BY
EGR
DRAWN BY
RPK
CHECKED BY
11/27/2023
DRAWING DATE

SUBMITTAL

NE 44TH - 47TH CONNECTOR
DESIGN SERVICES
ROADWAY CROSS-SECTIONS
STA 1+00 TO STA 7+00

JOB NO. AK 23-017
SHEET NO. 6



NOTE:
MSE = MECHANICALLY STABILIZED EARTH

CROSS-SECTIONS
SCALE: HORIZONTAL 1" = 20' VERTICAL 1" = 10'

NOT FOR CONSTRUCTION

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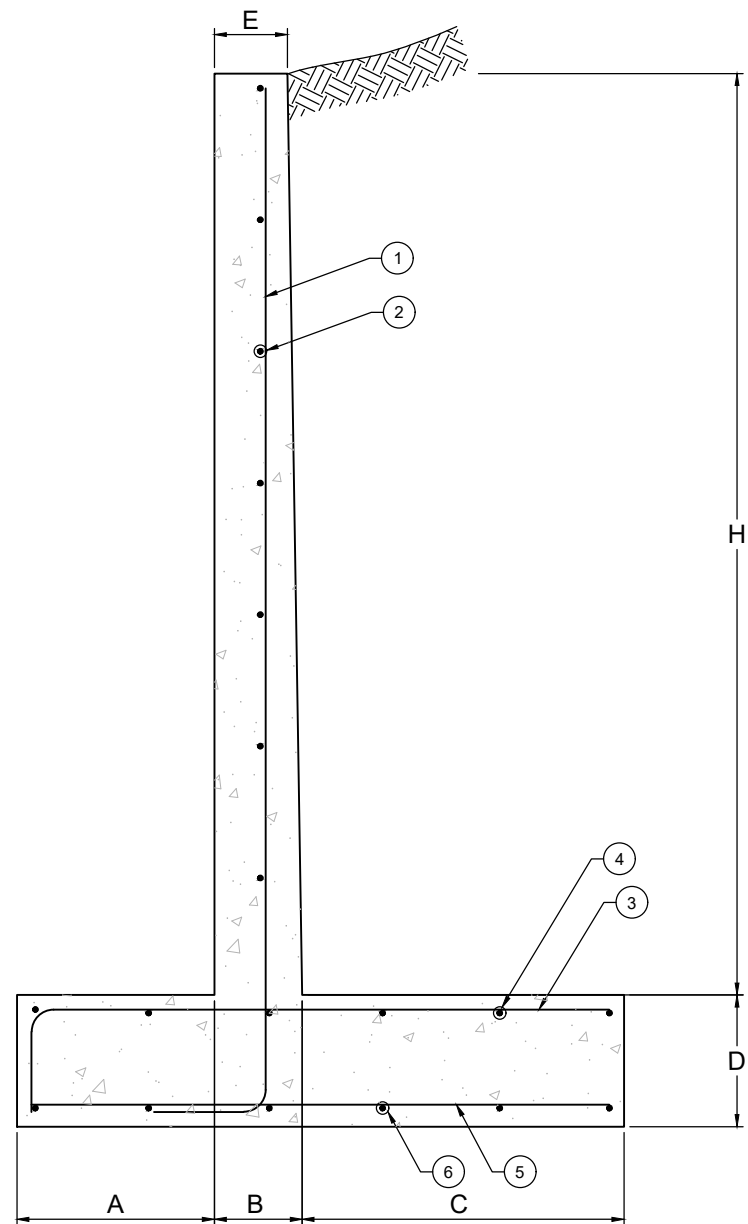
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NE 44TH - 47TH CONNECTOR
DESIGN SERVICES
ROADWAY CROSS-SECTIONS
STA 8+00 TO STA 11+50

JOB NO. AK 23-017
SHEET NO.

7

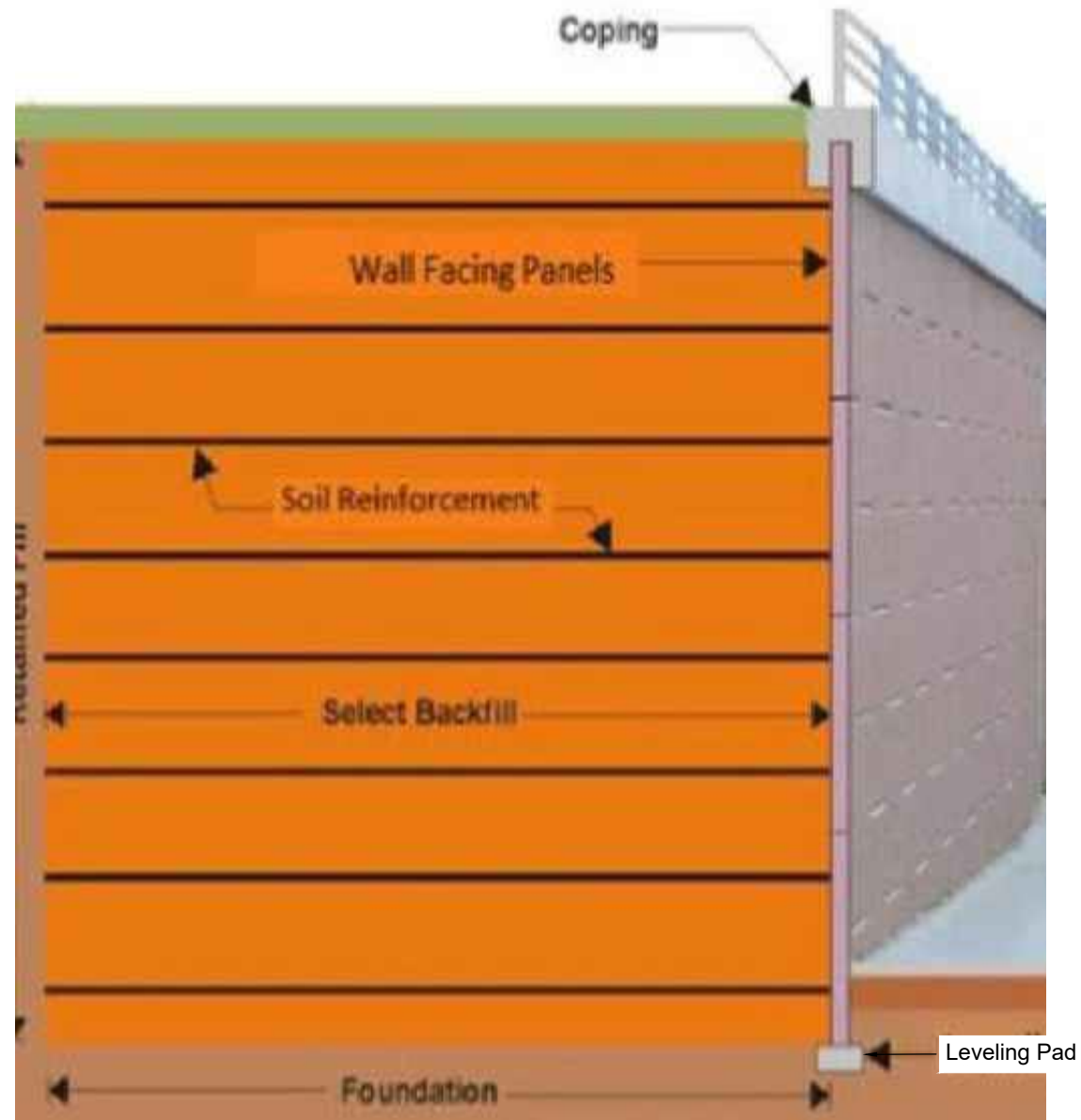


REBAR SCHEDULE					
1	2	3	4	5	6
#8 @ 6"	#6 @ 12"	#6 @ 6"	#6 @ 12"	#6 @ 12"	#6 @ 12"

WALL DIMENSIONS					
H	A	B	C	D	E
8' (MAX)	2'-0"	14"	3'-1"	18"	14"
12' (MAX)	2'-9"	14"	5'-4"	18"	14"

- NOTES:
- CAST-IN-PLACE WALL TO BE USED ON CUT SLOPES, STA. 5+75 TO STA. 9+25 (LEFT SIDE)
 - WALL SHOWN HERE IS AN ILLUSTRATION OF CONCEPT, NOT A FINAL DESIGN

REPRESENTATIVE CAST-IN-PLACE RETAINING WALL
SCALE: NTS



- NOTES:
- MSE WALLS TO BE USED ON ROADWAY EMBANKMENTS, STA. 2+75 TO STA. 6+35 AND STA. 7+80 TO STA. 10+15 (RIGHT SIDE) AND STA. 9+25 TO STA. 10+15 (LEFT SIDE).
 - WALL SHOWN HERE IS AN ILLUSTRATION OF CONCEPT, FINAL DESIGN MAY VARY SUBSTANTIALLY BASED ON COST AND TECHNICAL REQUIREMENTS

REPRESENTATIVE MECHANICALLY STABILIZED EARTH (MSE) WALL
SCALE: NTS

NOT FOR CONSTRUCTION

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NE 44TH - 47TH CONNECTOR
DESIGN SERVICES
WALL DETAILS

JOB NO. AK 23-017
SHEET NO.

8

**APPENDIX B
COST ESTIMATES**

(2 Pages)



**City of Lincoln City - NE 44th-47th Connector Design Services
Budget-Level Cost Estimate**

Date: 10/3/2023
By: Titan Takahata, Paul Knox
Reviewer: Fares Kekhia

Alternative 1 - 2:1 Side Slopes					
No.	Item	Qty	Unit	Unit Cost	Total Cost
SCHEDULE A - GENERAL CONDITION					
1	Mobilization (5%)	All Req'd	LS	\$227,800	\$227,800
2	Erosion Control	All Req'd	LS	\$50,000	\$50,000
3	Construction Survey Work	All Req'd	LS	\$30,000	\$30,000
SCHEDULE B - DEMOLITION					
4	Clear and Grubbing	2.48	AC	\$45,000	\$111,674
5	Sawcut Existing Pavement&Concrete	147	LF	\$10	\$1,470
6	Tree Removal			Not Included	
7	Removal Of Existing Surfacing	404	SY	\$50	\$20,211
8	Remove Existing Catch Basin	2	EA	\$1,100	\$2,200
SCHEDULE C - EARTHWORK					
9	1' Stripping	4,005	CY	\$50	\$200,250
10	Excavation	6,832	CY	\$40	\$273,278
11	Dispose of Excess Material, incl. Haul	6,832	CY	\$35	\$239,118
12	Imported Fill	18,946	CY	\$50	\$947,316
13	Embankment in Place	18,946	CY	\$30	\$568,390
SCHEDULE D - STORMWATER CONSTRUCTION					
16	24" Reinforced Concrete Pipe Culvert	129	LF	\$215	\$27,675
17	18" Reinforced Concrete Pipe Culvert	342	LF	\$160	\$54,710
18	12" Corrugated Polyethylene Pipe	650	LF	\$125	\$81,250
19	Concrete Inlets, Type CG-2	8	EA	\$4,500	\$36,000
20	Concrete Storm Sewer Manhole	7	EA	\$8,000	\$56,000
21	Stormwater Quantity & Quality Control Measures		Allowance		\$250,000
SCHEDULE E - ROADWAY CONSTRUCTION					
21	Roadway Fabric	4,120	SY	\$10	\$41,201
22	Base Rock (6")	1,084	TON	\$35	\$37,923
23	Leveling Rock (2")	523	TON	\$35	\$18,307
24	Level 2, 1/2" Asphalt Concrete Pavement Mixture	800	TON	\$175	\$721,019
25	Standard Curb and Gutter	2,354	LF	\$65	\$153,010
26	Concrete Sidewalk	9,460	SF	\$20	\$189,200
27	Extra for new Curb Ramps, incl. Truncated Domes	2	EA	\$2,500	\$5,000
28	Midwest Guardrail	693	LF	\$70	\$48,481
29	Guardrail Terminal, Non-Flar	6	EA	\$4,400	\$26,400
30	6' Fence	2,196	LF	\$55	\$120,770
31	4" White Painted Stripes	1,180	LF	\$2	\$2,360
32	Stop Bar and Crosswalk Thermoplastic	110	SF	\$10	\$1,100
33	Streetlights	16	EA	\$15,000	\$240,000
Total Constuction Cost					\$4,782,200
Contingency(20%)					\$956,440
Total Budget Cost					\$5,738,640

Notes: 1. The cost estimates above have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, construction phasing, and other variable factors. The estimate is based on material, equipment, and labor pricing as of October 2023. However, the costs will fluctuate based on worldwide conditions, recent market shortages, and energy prices.

City of Lincoln City - NE 44th-47th Connector Design Services
Budget-Level Cost Estimate

Date: 10/10/2023
 By: Titan Takahata, Paul Knox
 Reviewer: Fares Kekhia

Alternative 2 - With Retaining Walls					
No.	Item	Qty	Unit	Unit Cost	Total Cost
SCHEDULE A - GENERAL CONDITION					
1	Mobilization (5%)	All Req'd	LS	\$260,200.00	\$260,200.00
2	Erosion Control	All Req'd	LS	\$50,000	\$50,000
3	Construction Survey Work	All Req'd	LS	\$30,000	\$30,000
SCHEDULE B - DEMOLITION					
4	Clear and Grubbing	1.24	AC	\$45,000	\$55,888
5	Sawcut Existing Pavement & Concrete	147	LF	\$10	\$1,470
6	Tree Removal			Not Included	
7	Removal Of Existing Surfacing	404	SY	\$50	\$20,211
8	Remove Existing Catch Basin	2	EA	\$1,100	\$2,200
SCHEDULE C - EARTHWORK					
9	1' Stripping	2,481	CY	\$50	\$124,050
10	Excavation	5,110	CY	\$40	\$204,400
11	Dispose of Excess Material, incl. Haul	5,110	CY	\$35	\$178,850
12	Imported Fill	12,171	CY	\$50	\$608,550
13	Embankment in Place	12,171	CY	\$30	\$365,130
14	Retaining Wall, Cast-in-Place Concrete Semi-Grav Canti	3,275	SF	\$200	\$655,000
15	Retaining Wall, MSE	12,613	SF	\$85	\$1,072,105
SCHEDULE D - STORMWATER CONSTRUCTION					
16	24" Reinforced Concrete Pipe Culvert	60	LF	\$215	\$12,900
17	18" Reinforced Concrete Pipe Culvert	212	LF	\$160	\$33,872
18	12" Corrugated Polyethylene Pipe	650	LF	\$125	\$81,250
19	Concrete Inlets, Type CG-2	8	EA	\$4,500	\$36,000
20	Concrete Storm Sewer Manhole	7	EA	\$8,000	\$56,000
21	Stormwater Quantity & Quality Control Measures		Allowance		\$250,000
SCHEDULE E - ROADWAY CONSTRUCTION					
22	Roadway Fabric	4,120	SY	\$10	\$41,201
23	Base Rock (6")	1,084	TON	\$35	\$37,923
24	Leveling Rock (2")	523	TON	\$35	\$18,307
25	Level 2, 1/2" Asphalt Concrete Pavement Mixture	800	TON	\$175	\$721,019
26	Standard Curb and Gutter	2,354	LF	\$65	\$153,010
27	Concrete Sidewalk	9,460	SF	\$20	\$189,200
28	Extra for new Curb Ramps, incl. Truncated Domes	2	EA	\$2,500	\$5,000
29	Midwest Guardrail	693	LF	\$70	\$48,481
30	Guardrail Terminal, Non-Flar	6	EA	\$4,400	\$26,400
31	6' Fence	2,196	LF	\$55	\$120,770
32	4" White Painted Stripes	1,180	LF	\$2	\$2,360
33	Stop Bar and Crosswalk Thermoplastic	110	SF	\$10	\$1,100
34	Street Lights	16	EA	\$15,000	\$240,000
Total Constuction Cost					\$5,702,900
Contingency(20%)					\$1,140,580
Total Budget Cost					\$6,843,480

Notes: 1. The cost estimates above have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, construction phasing, and other variable factors. The estimate is based on material, equipment, and labor pricing as of October 2023. However, the costs will fluctuate based on worldwide conditions, recent market shortages, and energy prices.

APPENDIX C
GEOTECHNICAL RECONNAISSANCE SUMMARY

(4 Pages)

November 6, 2023

3177

Paul Knox, PE
Akana
6400 SW Lake Road, Suite 270
Portland, Oregon 97222

**Task 1 Geotechnical Engineering Services
NW 44th Street to NE 47th Street Connector
Lincoln City, Oregon**

Dear Mr. Knox,

Per your request, we have completed Task 1 for the above-referenced project. This letter summarizes the results of our services.

BACKGROUND

A proposed new roadway connecting NW 44th Street to NE 47th Street in Lincoln City, Oregon, crosses a forested ravine that is regionally mapped as a high landslide hazard area. Task 1 of our geotechnical engineering services for this project included:

- Perform a literature review of select publicly available information.
- Review and conduct a geologic interpretation of City-provided lidar.
- Perform a geologic reconnaissance to inform the future tasks.
- Identify subsurface exploration locations and appropriate drilling equipment.

REVIEW AND ASSESSMENT

We reviewed geology maps, geologic hazard maps, ground morphology maps (lidar hill shade), and aerial photographs available on the following internet websites and an application. Image copies of the specific maps, reports and photographs are available upon request.

- <https://ngmdb.usgs.gov/mapview/>
- <https://gis.dogami.oregon.gov/maps/geologicmap/>
- <https://gis.dogami.oregon.gov/maps/slido/>
- <https://gis.dogami.oregon.gov/maps/lidarviewer/>



- Google Earth Pro

At the time of our review, hill shade imagery, available from DOGAMI Lidar Viewer, based on lidar from 2009, was used in our interpretation.

- Watershed Sciences, 2009, Lidar Remote Sensing Data Collection: DOGAMI, Oregon North Coast Study Area, Delivery Area 9.

RECONNAISSANCE

A senior associate engineering geologist from our office completed a site reconnaissance on August 22, 2023. We offer the following summary of our field reconnaissance:

Landform Assessment:

- There is a “Ridge” of fill along the east side of the parking area (west of the connector from 47th Street) that contains siltstone and tuffaceous siltstone fragments, which suggests that in-place Nestucca Formation is near the ground surface in the graded parking area, and any sand from beach or wind is likely relatively thin.
- Dense vegetation is hiding slope details such as incised drainage, local erosion, and sediment deposits.
- The previously mapped landslide that is nearby north of the alignment is subdued and likely very old.

Geology Assessment:

- Anticipated subsurface conditions consist of surficial soil (likely windblown sand mixed with organics) overlying Quaternary terrace sand with gravel at bottom (est. 5-30 feet thick, based on nearby DWR-sourced well logs and nearby roadcuts), overlying Nestucca Formation siltstone and tuffaceous siltstone (mudstone).
- The Nestucca Formation is tectonically tilted approx. 10 to 30 degrees to the west. This formation has potential for occurrence of landslides prior to and after burial by terrace sediments.
- The Nestucca Formation is tectonically faulted in the region, but no faults are mapped at the specific site location; however, reasonable assumption is that it’s likely fractured, sheared, and weathered, to low strength.

PRELIMINARY CONCLUSIONS

Based on our document review and site reconnaissance, we offer the following preliminary conclusions regarding the proposed project.



- The west facing slopes appear to be Nestucca Formation mantled with sand (observed under fallen tree root bundle). Buried by the sand is likely paleo-landslide materials that should be included in subsurface investigation and evaluated for its potential impact to design.
- East facing slopes appear to cut across the bedding and are steeper (local slopes approach 30 to 40 degrees) and are likely mantled with sand soil.
- Groundwater is anticipated to be shallow throughout the area. Surface water was flowing within all drainages and drainage swales, and seeps were observed within a south-facing slope of a broad ridge immediately north of the proposed extension of connected 47th Street.
- Our document review and site reconnaissance did not identify geologic conditions that would preclude the proposed roadway extension, however, there is evidence of prior landsliding nearby along with high groundwater conditions that should be evaluated as part of the subsurface exploration program.
- Approximate proposed subsurface exploration locations are shown on the attached figure. Some clearing of large trees and access route construction may be necessary for a track mounted drill rig to access certain areas.

CLOSING

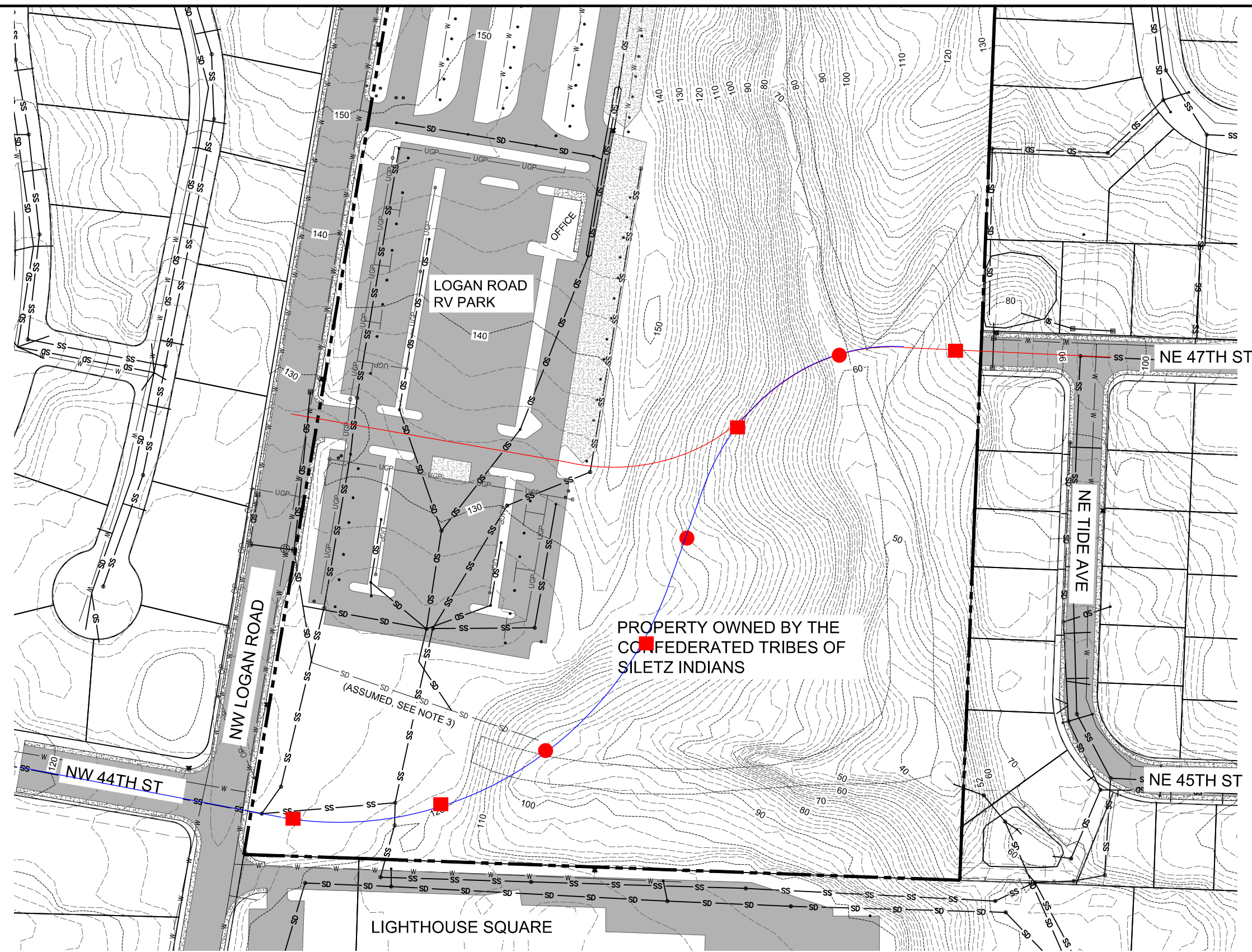
We appreciate the opportunity to assist Akana with this project. If you have questions please call us at (503) 452-1100.

Sincerely,

CORNFORTH CONSULTANTS, INC.

Charles M. Hammond, C.E.G.
Senior Associate Geologist

Greg A. Landau, P.E., G.E.
Senior Associate Geotechnical Engineer



LEGEND

EXISTING

- STORM CATCH BASIN
- ⊙ SANITARY SEWER MANHOLE
- ⊙ SANITARY SEWER CLEANOUT
- ⊙ STORM DRAIN MANHOLE
- ⊗ WATER VALVE
- UTILITY POLE
- ⊙ LIGHT POLE
- ⊗ FIRE HYDRANT
- UGP — UNDERGROUND POWER
- OHP — OVERHEAD POWER
- SD — STORM DRAIN
- SS — SANITARY SEWER
- W — WATER LINE
- x — FENCE
- — PROJECT BOUNDARY
- — TAX LOT
- — WETLANDS
- PAVEMENT
- ▨ CONCRETE SIDEWALK

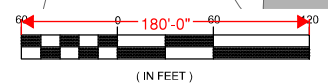
NOTE:

1. EXISTING FEATURES SHOWN ARE BASED ON GIS DATA AND AS-BUILT DRAWINGS PROVIDED BY CITY OF LINCOLN CITY AND SHOULD BE CONSIDERED APPROXIMATE.
2. WETLAND LIMITS DEPICTED HERE CAME FROM THE LOCAL WETLAND INVENTORY AND HAVE NOT BEEN DELINEATED IN THE FIELD.
3. STORM DRAIN LINE SHOWN AS ASSUMED WAS NEEDED TO ACCOUNT FOR FILL PLACED OVER THE NATURAL DRAINAGE COURSE THAT PREVIOUSLY EXISTED IN THIS LOCATION. IT WAS DRAWN FROM PIPE ENDS SHOWN ON AS-BUILT DRAWINGS AND EXTENDED TO TOE OF FILL SLOPE.

- Conceptual Test Pit Location
- Conceptual Boring Location



EXISTING CONDITIONS
SCALE: 1" = 60'



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LINCOLN CITY, OR, 97367
TERRY CHAMBERLIN, PE
(541)-996-1292

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NE 44TH - 47TH CONNECTOR
DESIGN SERVICES

EXISTING CONDITIONS
AND CONCEPTUAL EXPLORATION LOCATIONS

JOB NO. AK 23-017
SHEET NO. 1
Packet Pg. 33

**APPENDIX D
WETLAND INVESTIGATION**

(42 Pages)

WETLAND DELINEATION / DETERMINATION REPORT COVER FORM

2.A.a

A complete report and signed report cover form, along with [applicable review fee](#), are required before a report review timeline can be initiated by the Department of State Lands. All applicants will receive an emailed confirmation that includes the report's unique file number and other information.

Ways to submit report:

- ❖ **Under 50MB** - A single unlocked PDF can be emailed to: wetland.delineation@dsl.oregon.gov.
- ❖ **50MB or larger** - A single unlocked PDF can be uploaded to the [Jurisdiction Box.com](#) folder. Email wetland.delineation@dsl.oregon.gov of the new upload.
- ❖ Unbound paper report and signed cover form can be mailed to: Oregon Department of State Lands, 775 Summer Street NE, Suite 100, Salem, OR 97301-1279.

Ways to pay review fee:

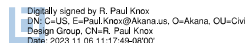
- ❖ By credit card on [DSL's epayment portal](#) after receiving the unique file number from DSL's emailed confirmation.
- ❖ By check payable to the Oregon Department of State Lands attached to the unbound paper report **OR** attached to the complete signed cover form if report submitted electronically.

Contact and Authorization Information

<input checked="" type="checkbox"/> Applicant <input type="checkbox"/> Owner Name, Firm and Address: Terry Chamberlain City of Lincoln City 801 SW Hwy 101 Third floor Lincoln City, OR 97367	Business phone # (541) 996-1292 Mobile phone # (optional) E-mail:
--	---

<input checked="" type="checkbox"/> Authorized Legal Agent, Name and Address (if different): Paul Knox, PE Akana 6400 SE Lake Road Suite 270 Portland, OR 97222	Business phone # (503) 652-9090 Mobile phone # (optional) E-mail: paul.knox@akana.us
--	--

I either own the property described below or I have legal authority to allow access to the property. I authorize the Department to access the property for the purpose of confirming the information in the report, after prior notification to the primary contact.

Typed/Printed Name: Paul Knox **Signature:** R. Paul Knox 

Date: 11/06/2023 **Special instructions regarding site access:** Contact Consultant below prior to site visit, if necessary.

Project and Site Information

Project Name: <u>NE 44th-47th Connection Road</u>	Latitude: <u>44.999029</u> Longitude: <u>-124.002801</u> decimal degree - centroid of site or start & end points of linear project
Proposed Use: <u>Street extension</u>	Tax Map # <u>071102B</u> Tax Lot(s) <u>102</u> Tax Map # _____ Tax Lot(s) _____
Project Street Address (or other descriptive location): <u>NW 44th Street to NE 47th Street</u>	Township <u>7 South</u> Range <u>11 West</u> Section <u>02</u> <u>QQ NW 1/4</u> Use separate sheet for additional tax and location information
City: <u>Lincoln City</u> County: <u>Lincoln County</u>	Waterway: <u>NA</u> River Mile: <u>NA</u>

Wetland Delineation Information

Wetland Consultant Name, Firm and Address: Jack Dalton Environmental Science & Assessment LLC 4831 NE Fremont Street, STE 2B Portland OR 97213	Phone # <u>(503) 478-0424</u> Mobile phone # (if applicable) E-mail: <u>jack@esapdx.com</u>
--	---

The information and conclusions on this form and in the attached report are true and correct to the best of my knowledge.

Consultant Signature: Jack Dalton  **Date:** 11/06/2023

Primary Contact for report review and site access is **Consultant** **Applicant/Owner** **Authorized Agent**

Wetland/Waters Present? **Yes** **No** Study Area size: 1.89 Total Wetland Acreage: 0.2240

Check Applicable Boxes Below

<input type="checkbox"/> R-F permit application submitted <input type="checkbox"/> Mitigation bank site <input type="checkbox"/> EFSC/ODOE Proj. Mgr: _____ <input type="checkbox"/> Wetland restoration/enhancement project (not mitigation) <input type="checkbox"/> Previous delineation/application on parcel If known, previous DSL # _____	<input type="checkbox"/> Fee payment submitted \$ _____ <input type="checkbox"/> Resubmittal of rejected report (\$100) <input type="checkbox"/> Request for Reissuance. See eligibility criteria. (no fee) DSL # _____ Expiration date _____ <input type="checkbox"/> LWI shows wetlands or waters on parcel Wetland ID code _____
---	---

For Office Use Only

DSL Reviewer: _____	Fee Paid Date: _____ / _____ / _____	DSL WD # _____
Date Delineation Received: _____ / _____ / _____	DSL App.# _____	

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INTRODUCTION

Environmental Science & Assessment, LLC (ES&A) conducted a wetland delineation for the City of Lincoln City and the Confederated Tribes of Siletz Indians (CTSI) for a proposed 44th-47th Connection Road in Lincoln City, Oregon, Lincoln County (Figure 1). The site is comprised of a portion of the southeastern areas of one tax lot, totaling 1.89-acres out of the 20.37-acre tax lot (TL#071102B 102) (Figure 2). The tax lot encompassing the project area is mapped on Lincoln County's assessor map within the northwest ¼ of Section 02 Township 7 South, Range 11 West (TL# 071102B) (Figure 2) (WM).

LANDSCAPE SETTING AND LAND USE

The proposed road alignment study area is located within undeveloped forest habitat that continues north and west and southeast within the surrounding parcel. Logan Road RV Park is located to the west within the tax lot. To the east the project area is bordered by a residential subdivision and to the south by commercial development including a café, grocery store, dollar store, bank, and more. There is one of three water reservoirs located north of the project site at Roads End that holds 4.25 million gallons of supply water at 160 feet of elevation.

Access to the site is from a road stub of NE 47th Street at the eastern tax lot boundary, and from the southwest corner of the tax lot at the intersection of Logan Road and NW 44th Street. The southern end of the road alignment extends through an undeveloped open field (Figure 5).

There are three plant communities onsite. Within the southwest of the tax lot there is a cleared and mowed open field adjacent to the intersection of NW Logan Road and NW 44th Street. The plant community within this area is comprised of a perimeter of shore pine (*Pinus contorta*), a minimal shrub stratum of invasive Himalayan blackberry (*Rubus armeniacus*) and invasive scotch broom (*Cytisus scoparius*), and a dominant herbaceous stratum of spikerush (*Eleocharis macrostachya*), tall false fescue (*Schedonorus arundinaceus*), velvet grass (*Holcus lanatus*), tansy ragwort (*Senecio jacobaea*), ox-eye daisy (*Leucanthemum vulgare*), hairy cats ear (*Hypochaeris radicata*), and English plantain (*Plantago lanceolata*).

The majority of the site is comprised of a mixed forest with a canopy of red alder (*Alnus rubra*) and Sitka spruce (*Picea sitchensis*), with an understory of red elderberry (*Sambucus racemosa*), English holly (*Ilex aquifolium*), beaked hazelnut (*Corylus cornuta*), Himalayan blackberry (*Rubus armeniacus*), and saplings of red alder and Sitka spruce. The herbaceous stratum is comprised of common swordfern (*Polystichum munitum*), salal (*Gaultheria shallon*), and trailing blackberry (*Rubus ursinus*).

Immediately adjacent to the onsite tributaries and wetlands the habitat is a riparian forest with a canopy of red alder, an understory of Himalayan blackberry, red-osier dogwood (*Cornus sericea*), and salmonberry (*Rubus spectabilis*). The herbaceous stratum is comprised of common swordfern and slough sedge (*Carex obnupta*).

Topography onsite was reviewed prior to the field investigation through DOGAMI LiDAR, with the proposed road alignment being divided by a ravine of a drainage that flows through the central area of the site tax lot, which then flows west and exits the site through the southwest corner. The lowest point onsite is within the southern area of the tax lot. USGS mapping shows a similar drainage pathway through the site and Lincoln City stormwater mapping indicates the downstream drainage outfalls to a storm pipe in the southeast corner of the project tax lot and is

piped southeast to a tributary south of State Highway 101 that eventually drains to Devil's Lake (Appendix D).

Soil survey mapping indicates two soil types onsite, both non-hydric. The eastern area of the site is mapped as Fendall-Winema silt loams, 15 to 35 percent slopes (Map unit 19E, Hydric rating = 0). The southwest and a tip of the northwest study area corner is mapped as Winema-Fendall silt loams, 3 to 15 percent slopes (Map unit 64C, Hydric rating = 0.) (NRCS, Web Soil Survey, 2023).

SITE ALTERATIONS

Review of historic aerial photography available on Google Earth from the years 1994 to 2019 shows that little has changed onsite. The majority of the site has remained undeveloped forested land with open field in the southwest corner. In the surrounding area of the vicinity of the project site, there have been some alterations and developments. the RV park Within the western area of the parcel was constructed in the early 2000s, and the eastern subdivision began development in 2005 with houses continually being added along the eastern tax lot border from 2012 to 2015. North of the site, forest contiguous with the parcel north of the road alignment was cleared between August 2011 and September 2012. (Google Earth Pro).

PRECIPITATION DATA AND ANALYSIS

Precipitation data and analysis collected for the field visit is used for Table 1. There was 0.00-inches of observed precipitation on October 12th, 2023. There was 1.16-inches recorded in the two weeks prior to the October field visit. Water year-to-date (WYTD) was 0% of normal during the October visit, though this was due to the fact that the current water year to date has just begun (Table 1). Observed data for the field visit in Table 1 are from CoCORaHS station OTIS 2 NE, OR about 4.46-miles to the northeast of the site.

According to the WETS table for NWS station OTIS 2 NE, OR, observed precipitation in July 2023 was lower than normal range, with August 2023 and September 2023 within normal range (Table 2).

Table 1. Precipitation Data Prior to Field Observations

Field Date	Rainfall on Field Date	Rainfall Two Weeks Prior to Field Date	Observed Rainfall for the Water Year-to-Date (WYTD)	Percent Normal Water Year-to-Date
October 12th, 2023	0.00	1.16	0.00*	0%*

Source: Natural Resource Conservation Service (NRCS) Agricultural Climate Information System (AgCIS) for Lincoln City County, WETS station: OTIS 2 NE, OR.

*Water year recently started. 2022-2023 water year recorded 86% of normal.

Table 2. Monthly Observed Precipitation Preceding 2023 field observations

Prior Three Months	¹ Avg. Precip.	¹ 30% Chance Will Have		Observed Precip.	Within Normal Range?
		Less Than	More Than		
July 2023	0.65	0.24	0.73	0.21	No, lower
August 2023	1.24	0.39	1.48	0.45	Yes
September 2023	3.39	1.92	4.13	2.91	Yes

Source: Natural Resource Conservation Service (NRCS) Agricultural Climate Information System (AgCIS) for Lincoln City County, WETS station: OTIS 2 NE, OR. ¹Average and exceedance values based on years 2000-2023 to represent normal.

SITE SPECIFIC METHODOLOGY

All boundaries of wetlands or waterways were determined using the methodology provided in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (USACE, 2010). Field data was collected in accordance with the Oregon Administrative Rules for Wetland Delineation Report Requirements and for Jurisdictional Determination for the Purpose of Regulating Fill and Removal within Waters of the State (OAR 141-90-0005-141-90-0055).

Two levels of investigation for the wetland delineation included a review of existing information and an on-site investigation of the study area. Prior to conducting the on-site investigation, ES&A reviewed available data pertaining to the wetland delineation.

Reviewed data included:

- Aerial Photographs: 1994-2019 (Google Earth);
- Natural Resource Conservation Service (NRCS) *Soil Survey of Lincoln County Area, Oregon* (Web Soil Survey, 2023);
- Oregon Department of Geology and Mineral Industries (DOGAMI) Lidar Viewer;
- City of Lincoln City Local Wetland Inventory (LWI) Map Lincoln County, OR area (SRI/Shapiro 1996);
- U.S. Geological Survey (USGS) 1:24,000 Topographic Map (MetroMap, 2013).

ES&A conducted the site evaluation on October 12th, 2023. Six (6) wetland delineation data plots were recorded while delineating the wetland boundary onsite. Wetland delineation methods used for test pits and establishing wetland boundaries onsite followed the methodology provided in the *Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1* (1987 Manual) (Environmental Laboratory, 1987). The wetland boundaries and data plot locations were flagged and mapped with a handheld Trimble Geo 7x GPS and GNSS antenna in the field with accuracy of ±2-feet.

WETLANDS

Two unnamed tributaries with a confluence in the study area and wetlands along the banks were delineated onsite. Wetland A and B total 9,776 SF or 0.22-AC (Figure 6).

Unnamed Tributary A

The Unnamed Tributary A is classified as Riverine Flow Through (RFT) and Riverine Lower Perennial Streambed that is Seasonally flooded (R2SBC). This tributary begins approximately 0.30 miles north of the project site and tax lot according to the Local Wetland Inventory (LWI) for Lincoln City, entering the tax lot from the northwest corner. The tributary flows south and confluences with Unnamed Tributary B within the project area. The channel is narrow in the northwest where it enters the site, and is incised approximately 1 foot, the channel topography widens and flattens into a basin where Wetland B is mapped, and this flattened channel basin continues offsite of the project area to the south. The average width of the stream observed during the field investigation is approximately 2.5 to 3 feet. The channel enters the project area

from the northwest and continues outside the project area to the southeast, where the channel curves and flows east, entering the southern project area from the northeast.

The Unnamed Tributary has a drainage basin of 34.5 AC that extends northwest from the confluence of Tributaries A and B according to an USGS StreamStats Report. The flow duration statistics for this tributary records the channel having a small flow, with 95 percent of flow duration as 0.00933 cubic feet per second, and 5 percent of flow duration at 0.952 cubic feet per second.

The plant community surrounding Unnamed Tributary A includes a canopy of Sitka spruce and red alder, with red elderberry, salmonberry, and Himalayan blackberry in the understory with an herbaceous stratum comprised of salal and swordfern with slough sedge along the banks where wetlands are present. Tributary A gets its hydrology from runoff, precipitation, and seeps and springs along the channel from groundwater discharge.

Unnamed Tributary B

The Unnamed Tributary B is classified as a Riverine Flow Through (RFT) and Riverine Intermittent Streambed that is Seasonally Flooded/Saturated (R4SBE). The tributary begins from a 20" culvert likely piped from a storm inlet and water quality facility 45 feet northeast of the tributary. The tributary flows southwest and confluences with Unnamed Tributary A approximately 170 feet after entering the project area tax lot. The tributary averages 3 feet in width but is narrow where the channel begins at the culvert. The channel is incised and there is no wetland along the southern bank until the tributary confluences with Tributary A. The unnamed tributary has a drainage basin of 22.5-AC according to the USGS StreamStats Report for this drainage. The flow duration statistics for Tributary B report a small flow, with 95 percent of flow duration recorded at 0.00596 cubic feet per second, and 0.619 cubic feet per second during 5 percent of flow duration.

The plant community surrounding Tributary B is a canopy of Sitka spruce, an understory of salmonberry, English holly, beaked hazelnut, and Himalayan blackberry with an herbaceous stratum of salal, slough sedge, and common swordfern. This tributary gets its hydrology from storm water flow from the off-site water quality facility pond, as well as seeps and springs from groundwater flow.

From information received from project engineers, the 20' storm outfall culvert mapped as an outlet for Tributaries A and B channels the flow into public utility storm drains which pipe the water flow to south of Highway 101, where it outlets in Devil's Lake via a narrow drainage channel.

Wetland A

The wetland is a 2,232 SF (0.051 AC) Riverine flow through (RFT) and Palustrine Forested Broad leaved Deciduous seasonally flooded/saturated wetland (PFO1E) within the southwestern area of the project site. A short tributary flows east from an existing 20-inch culvert that discharges stormwater from the southwestern corner of the taxlot. The secondary tributary channel hydrology expands where Wetland A is mapped, due to topographic changes and sediment deposition from the culvert. The tributary continues east through the study area within an incised channel approximately 2 feet with a width of 2 to 3 feet and continues to flow east within a narrow channel where it drains to a storm inlet (See current aerial mapping in Appendix D) in the southeast corner of the taxlot (Figure 6, 6a).

Wetland A extends eastward from the existing culvert to where the channel for Tributary A becomes incised and the banks steepen. Wetland criteria including hydrology, soils, and vegetation were met within the wetland (Appendix B, DP-3).

The plant community for Wetland A has a canopy of red alder, an understory of Himalayan blackberry and salmonberry, and a herbaceous stratum of bracken fern (*Pteridium aquilinum*), common swordfern, and slough sedge.

Wetland A hydrology includes surface saturation, hydrogen sulfide odor, and a high-water table. This hydrology is sourced from backflow of Unnamed Tributary A, precipitation, and sublateral groundwater flow.

Wetland B

The wetland is a 7,544 SF (0.173 AC) wetland classified as Riverine Flow Through (RFT) and Palustrine Forested Needle-leaved evergreen seasonally flooded/saturated (PFO4E). Wetland criteria including hydrology, soils, and vegetation were met within the wetland (Appendix B, DP-4 & DP-5) and DP-6 documents the wetland does not extend along the southern bank of Unnamed Tributary B. This wetland closely follows the channel and inlets of Unnamed Tributaries A & B and continues offsite of the project area to the south.

The plant community for Wetland B is comprised of a canopy of Sitka spruce and red alder, with an understory of salmonberry, red elderberry, and an herbaceous stratum of slough sedge and common swordfern.

Wetland B gets its hydrology from bank overflow of Tributary A and B, precipitation, runoff residential subdivision to the east, and sublateral groundwater flow.

DEVIATION FROM LWI OR NWI

The National Wetland Inventory maps one wetland in the southeastern area of the project area tax lot that is classified as a Palustrine Emergent Persistent seasonally flooded wetland (PEM1C) and does not map any tributaries onsite. The Local Wetland Inventory (LWI) for the City of Lincoln City maps a thin wetland that follows closely to what was delineated onsite within the northern area of the project site, however within the southeastern area of the project site the wetland on the LWI does not correspond with what was delineated in-field (Figure 3).

RESULTS AND CONCLUSIONS

ES&A delineated two unnamed tributaries and two wetlands on-site (Table 3).

Table 3. Waters/Wetlands Summary

Feature	Area (acres/square feet or length in feet)	HGM Class	Cowardin Class	Notes
Unnamed Tributary A	NA	RFT	R2SBC	
Unnamed Tributary B	NA	RFT	R4SBE	
Wetland A	2,232 SF	RFT	PFO1E	
Wetland B	7,544 SF	RFT	PFO4E	

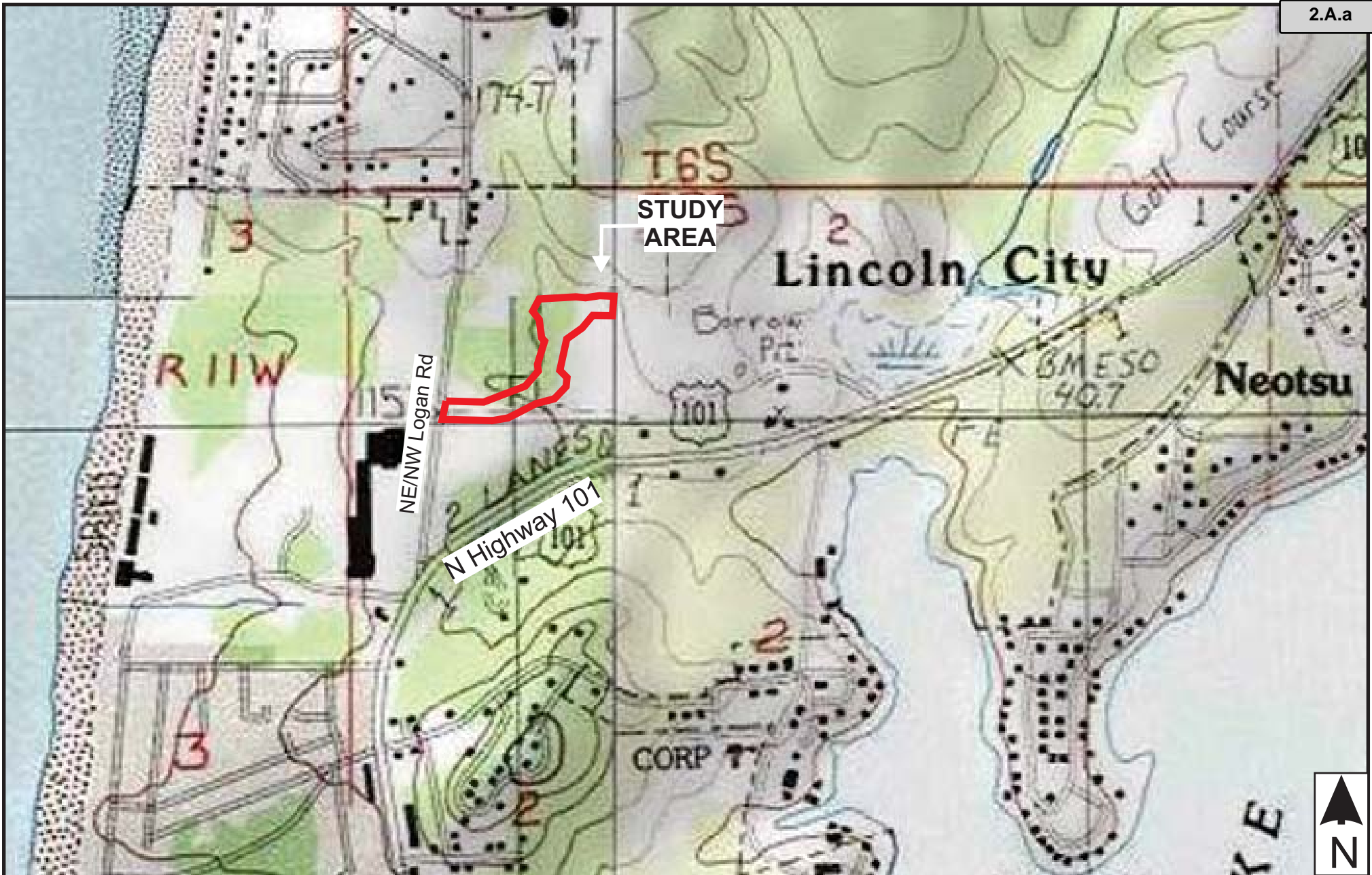
DISCLAIMER

As required by the Administrative Rules for Wetland Delineation Report Requirements and for Jurisdictional Determination for the Purpose of Regulating Fill and Removal within Waters of the State the following statement is made:

“This report documents the investigation, best professional judgment and conclusions of the investigator. It is correct and complete to the best of my knowledge. It should be considered a Preliminary Jurisdictional Determination of wetlands and other waters and used at your own risk unless it has been reviewed and approved in writing by the Oregon Department of State Lands in accordance with OAR 141-090-0005 through 141-090-0055.”

Wetlands are by definition transitional areas; wetland boundaries may change with time. All wetland delineations performed for this study, as well as the conclusions drawn in this report, should be reviewed by the appropriate regulatory agencies prior to any detailed site planning or construction activities. ES&A, therefore, recommends that this wetlands study be verified with the appropriate regulatory agencies as soon as practical. The results and conclusions of this report represent the authors' best professional judgment, based upon information provided by the project proponent in addition to that obtained during the course of this study. No other warranty, expressed or implied, is made by ES&A.

APPENDIX A. FIGURES



Source: Metro Data Resource Center. <http://gis.oregonmetro.gov/metromap/>

Environmental
Science &
Assessment, LLC

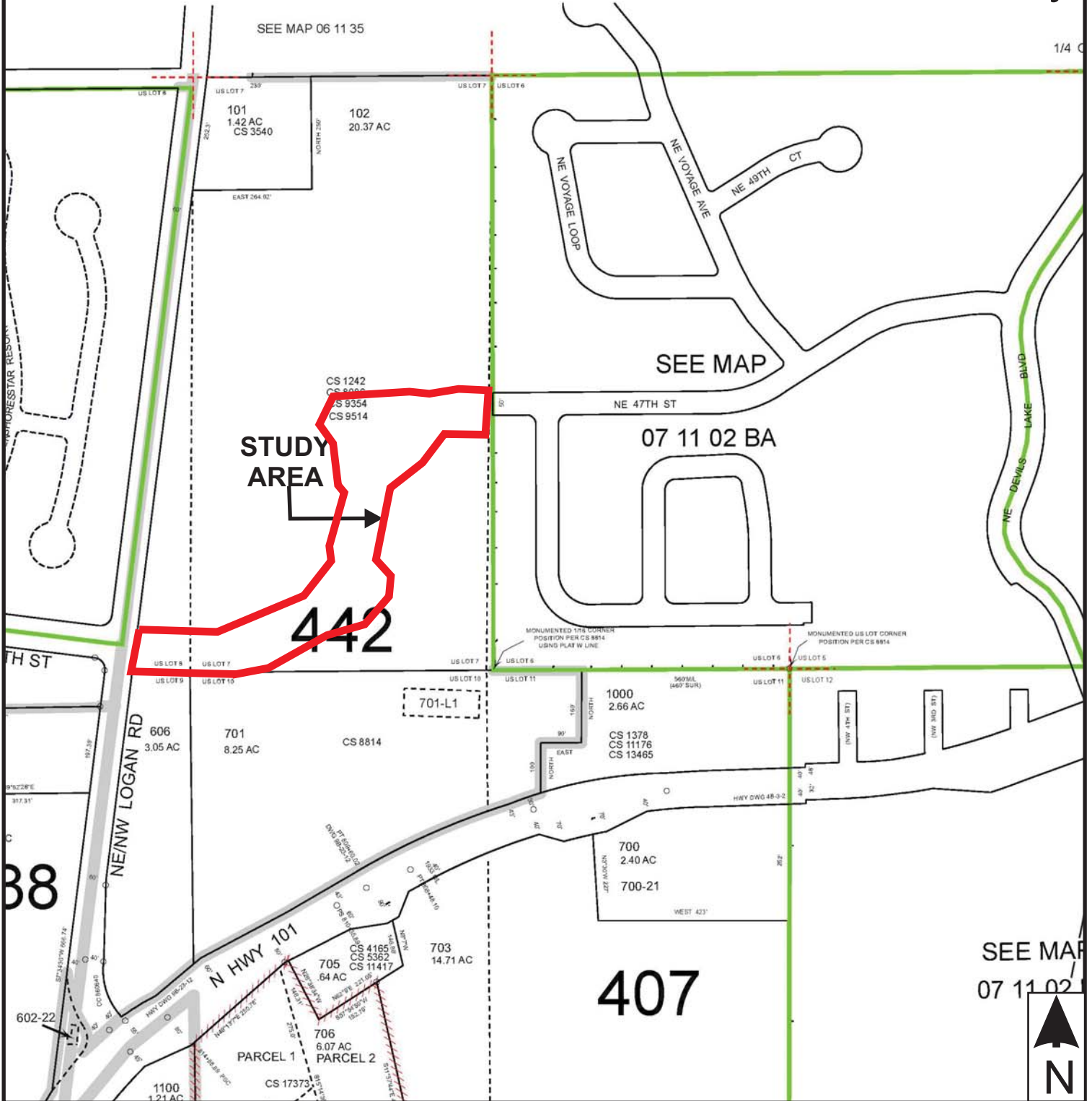
Vicinity Map
44th - 47th Connector
Lincoln City, Oregon



Figure 1

N.W.1/4 SEC.2 T.7S. R.11W. W.M.
LINCOLN COUNTY
1" = 200'

07 11 02 B
Lincoln City



Source: www.ormap.net

Environmental
Science &
Assessment, LLC

Tax Lot Map
NW 44th - NE 47th St. Connector
Lincoln City, Oregon

Figure 2



U.S. Fish and Wildlife Service National Wetlands Inventory

NWI -



April 4, 2023

Source: fws.gov/wetlands/data/Mapper.html

Environmental
Science &
Assessment, LLC

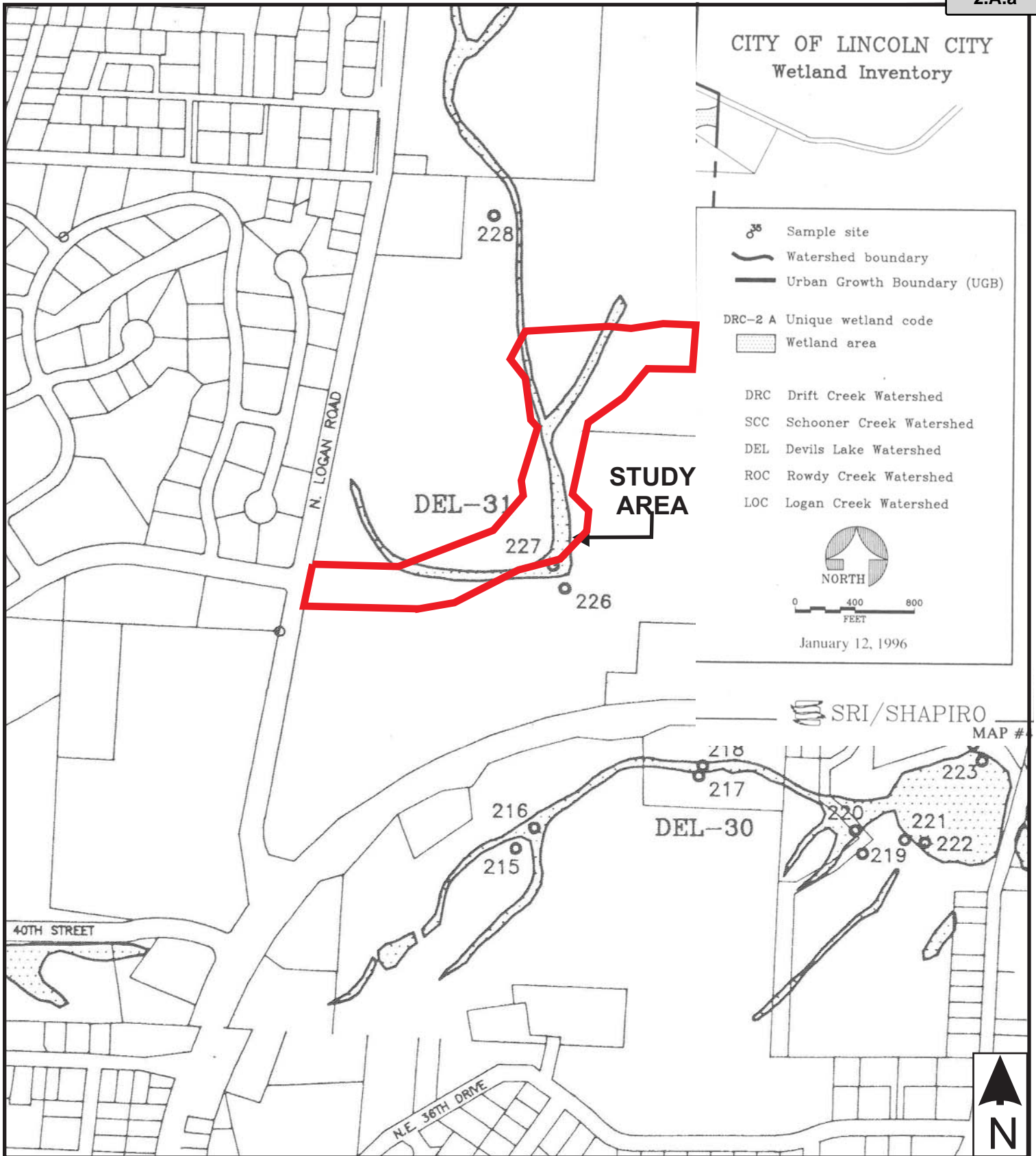


National Wetland Inventory NW 44th - NE 47th St. Connector Lincoln City, Oregon

Figure 3a



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Source: Lincoln City LWI. SRI/Shapiro, Inc, 11/1996. Accessed: <https://docs.dsl.state.or.us/PublicReview/0/doc/863310/Electronic.aspx>

Environmental
Science &
Assessment, LLC



Local Wetland Inventory
NW 44th - NE 47th St. Connector
Lincoln City, Oregon

Figure 3b





Mapped Soils:

19E - Fendall-Winema silt loams, 15 to 35 % slopes, Hydric Rating = 0

64C - Winema-Fendall silt loams, 3 to 15 % slopes, Hydric Rating = 0



Source: Web Soil Survey, Lincoln County, Oregon available at:<http://websoilsurvey.nrcs.usda.gov/app/>.

Environmental
Science &
Assessment, LLC



NRCS Soil Survey Map
NW 44th - NE 47th St. Connector
Lincoln City Oregon

Figure 4





Source: Google Earth Pro. <http://earth.google.com>

Imagery date: 07/24/2019

Environmental
Science &
Assessment, LLC

Aerial Map
NW 44th - NE 47th St. Connector
Lincoln City, Oregon

Figure 5

0 100 200 ft

LEGEND

- - - - - STUDY AREA = 1.89 ACRES±
- - - - - PROPERTY BOUNDARY
- - - - - PROPOSED ROW
- - - - - WETLAND STREAM CENTERLINE (FIELD LOCATED)
- - - - - WETLAND STREAM CENTERLINE (TOPOGRAPHICALLY LOCATED)
- WETLAND - 0.224 ACRES±
- DP-1 WETLAND DATA PLOT
- ↖ 4 PHOTO POINT

The wetland boundary, OHWL and the data plot locations were surveyed with a with a hand-held GPS unit with ±2-foot accuracy.
The base topography and site boundary were professionally surveyed.

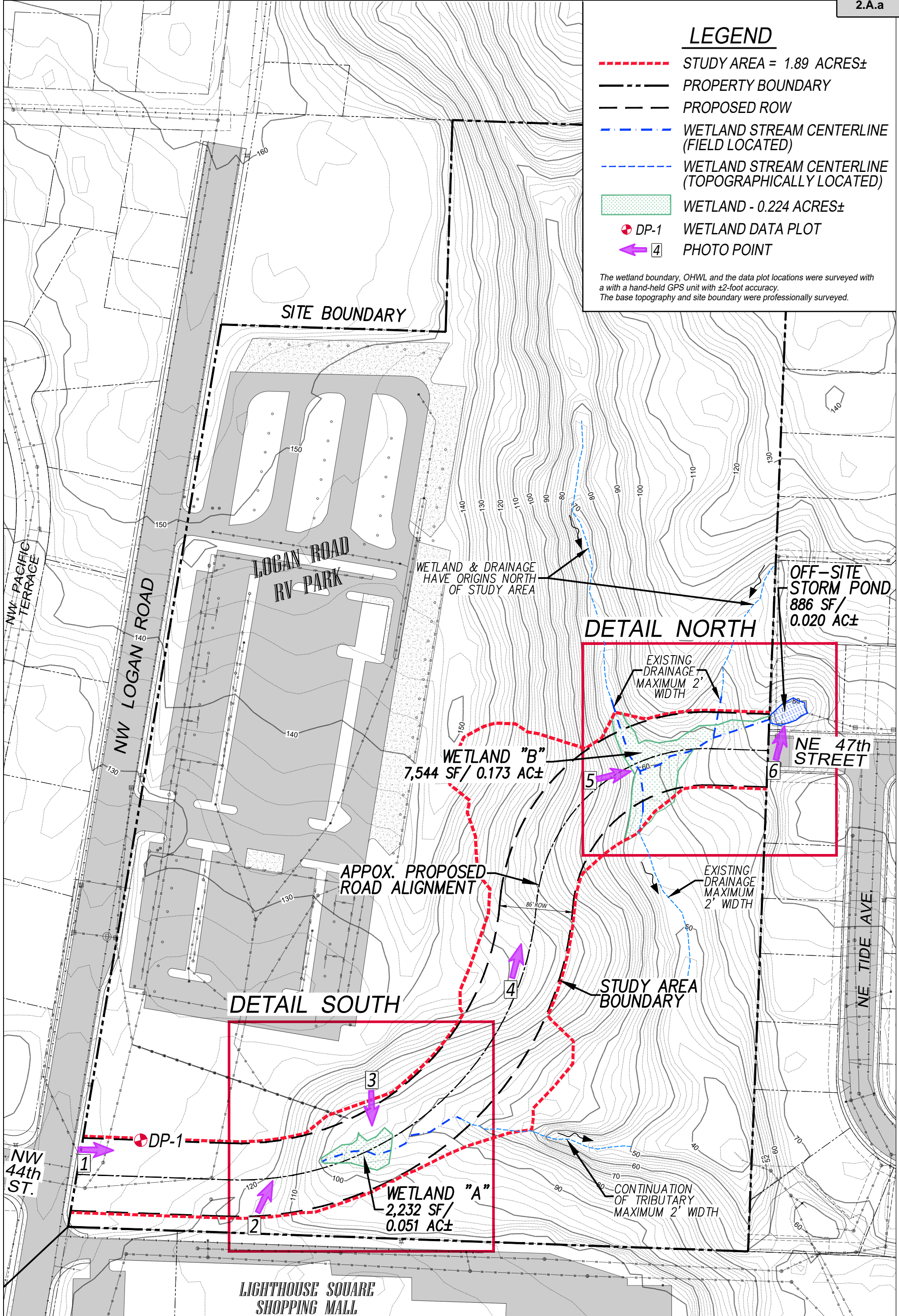


FIGURE 6A

Rev: 00/00
Job: 23015
Date: 10/23/23
Mod. By: PD
Base Map Source: AKANA Engineering

N
1"=100'

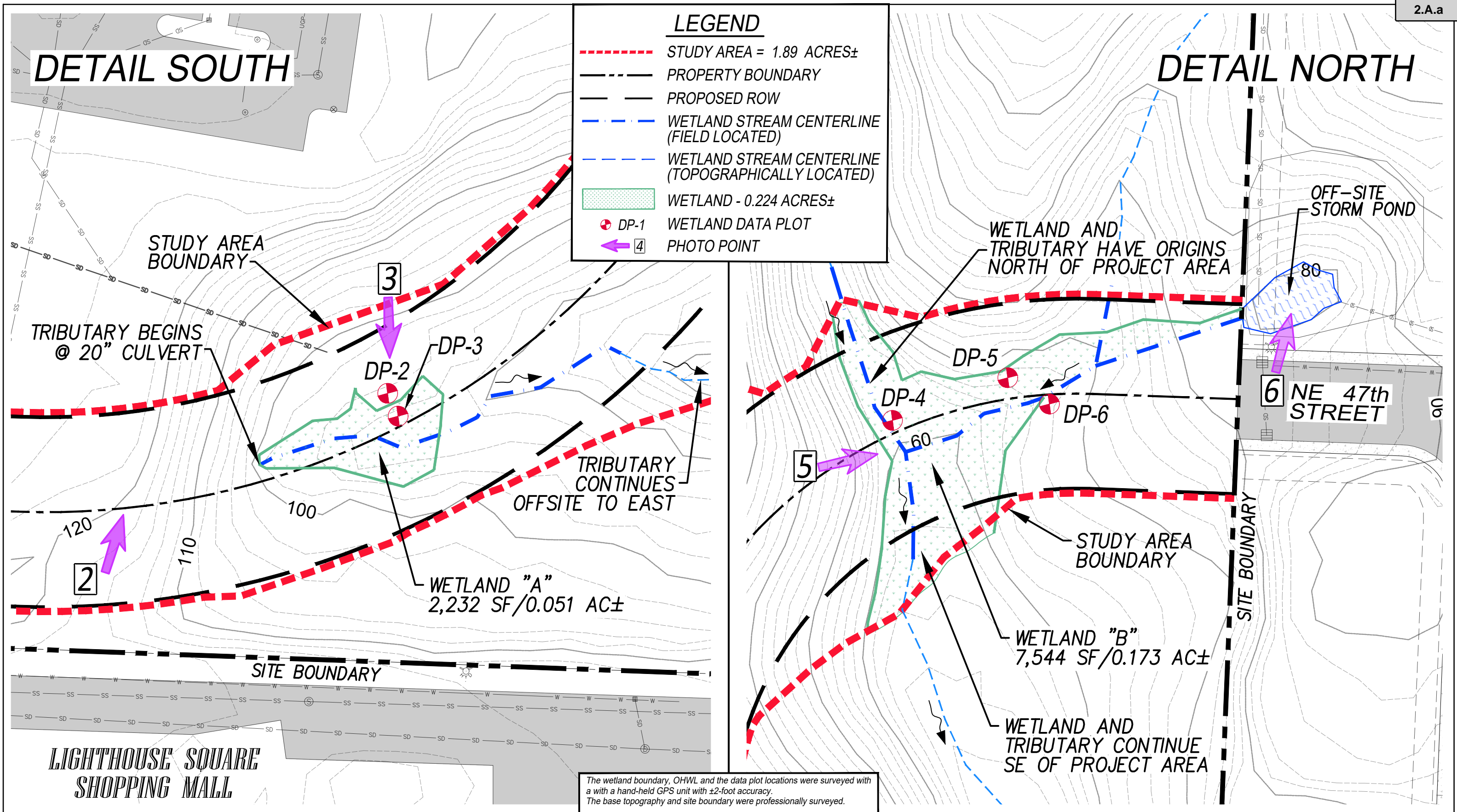
0 50 100

EXISTING CONDITIONS

NW 44th St. - NE 47th St. Connector Lincoln City, Oregon

Environmental Science & Assessment, LLC
4831 NE Fremont St., Suite 2B
Portland, OR 97213
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Environmental Science & Assessment, LLC

4831 NE Fremont St., Suite 2B
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Phone: 503.478.0424
www.esapdx.com

EXISTING CONDITIONS
NW 44th St. - NE 47th St. Connector
Lincoln City, Oregon

Base Map Source:	AKANA Engineering
Modified By:	PD
Date:	10/23/2023
Rev:	
Proj. #	23015



FIGURE 6B

1"=40'

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APPENDIX B. DATA SHEETS

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Lincoln City 44-47th Connector City/County: Lincoln City Sampling Date: 10/12/23
 Applicant/Owner: Akana State: OR Sampling Point: DP-1
 Investigator(s): Jack Dalton and Racine Robinson Section, Township, Range: Sec 02, T7S, R11W
 Landform (hillslope, terrace, etc.): field Local relief (concave, convex, none): none Slope (%): >5
 Subregion (LRR): A-Northwest Forests and Coasts Lat: 44.595911 Long: -124.0974 Datum: NAD 83
 Soil Map Unit Name: (64C) Winema-Fendall silt loam, 3-15% slopes, Hydric rating = 0 NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Hydric Soil Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Wetland Hydrology Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Remarks:			

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u>30' diameter</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A)
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>2</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
<u>0</u> = Total Cover				
Sapling/Shrub Stratum (Plot size: <u>30' diameter</u>)				Total % Cover of: _____ Multiply by: _____
1. _____	_____	_____	_____	OBL species <u>0</u> x 1 = <u>0</u>
2. _____	_____	_____	_____	FACW species <u>2</u> x 2 = <u>4</u>
3. _____	_____	_____	_____	FAC species <u>32</u> x 3 = <u>96</u>
4. _____	_____	_____	_____	FACU species <u>7</u> x 4 = <u>20</u>
5. _____	_____	_____	_____	UPL species <u>0</u> x 5 = <u>0</u>
<u>0</u> = Total Cover				Column Totals: <u>41</u> (A) <u>120</u> (B)
Herb Stratum (Plot size: <u>5' diameter</u>)				Prevalence Index = B/A = <u>2.93</u>
1. <u>Leucanthemum vulgare</u>	<u>5</u>	_____	<u>FACU</u>	Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% <input checked="" type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ 5 - Wetland Non-Vascular Plants ¹ ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Rubus spectabilis</u>	<u>2</u>	_____	<u>FAC</u>	
3. <u>Hypochaeris radicata</u>	<u>T</u>	_____	<u>FACU</u>	
4. <u>Plantago lanceolata</u>	<u>T</u>	_____	<u>FACU</u>	
5. <u>Fragaria vesca</u>	<u>2</u>	_____	<u>FACU</u>	
6. <u>Eleocharis sp</u>	<u>60</u>	_____	<u>NL</u>	
7. <u>Schedonorus arundinaceus</u>	<u>20</u>	<u>x</u>	<u>FAC</u>	
8. <u>Senecio jacobea</u>	<u>5</u>	_____	<u>NL</u>	
9. <u>Holcus lanatus</u>	<u>10</u>	<u>x</u>	<u>FAC</u>	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
<u>104</u> = Total Cover				
Woody Vine Stratum (Plot size: _____)				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
<u>0</u> = Total Cover				
% Bare Ground in Herb Stratum <u>0</u>				
Remarks: Eleocharis sp - Not listed - not used in dominance test. Species not common PNW species.				

SOIL

Sampling Point: DP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-11	10YR 2/2	100					Silt loam	
11-14	10YR 2/2	98	7.5YR 3/4	2	C	M	Silt loam	
14-18	10YR 5/8	88	10YR 3/6	2	C	M	Silt loam	
	10YR 3/2	10						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____
 Water Table Present? Yes _____ No ✓ Depth (inches): _____
 Saturation Present? Yes _____ No ✓ Depth (inches): _____
 (includes capillary fringe)

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Lincoln City 44-47th Connector City/County: Lincoln City Sampling Date: 10/12/23
 Applicant/Owner: Akana State: OR Sampling Point: DP-2
 Investigator(s): Jack Dalton and Racine Robinson Section, Township, Range: Sec 02, T7S, R11W
 Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 15
 Subregion (LRR): A-Northwest Forests and Coasts Lat: 44.595911 Long: -124.0974 Datum: NAD 83
 Soil Map Unit Name: (19E) Fenall-Winema silt loams, 15-35% slopes, Hydric rating = 0 NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Hydric Soil Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Wetland Hydrology Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Remarks:			

VEGETATION – Use scientific names of plants.

<u>Tree Stratum</u> (Plot size: <u>30' diameter</u>)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <u>Picea sitchensis</u>	80	x	FAC	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A) Total Number of Dominant Species Across All Strata: <u>7</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>57</u> (A/B)																
2. <u>Alnus rubra</u>	20	x	FAC																	
3. _____																				
4. _____																				
<u>100</u> = Total Cover				Prevalence Index worksheet: <table style="width:100%; border:none;"> <tr> <td style="width:50%;">Total % Cover of:</td> <td style="width:50%;">Multiply by:</td> </tr> <tr> <td>OBL species <u>30</u></td> <td>x 1 = <u>30</u></td> </tr> <tr> <td>FACW species <u>0</u></td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>115</u></td> <td>x 3 = <u>345</u></td> </tr> <tr> <td>FACU species <u>76</u></td> <td>x 4 = <u>304</u></td> </tr> <tr> <td>UPL species <u>0</u></td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>221</u> (A)</td> <td><u>679</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u>3.07</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>30</u>	x 1 = <u>30</u>	FACW species <u>0</u>	x 2 = <u>0</u>	FAC species <u>115</u>	x 3 = <u>345</u>	FACU species <u>76</u>	x 4 = <u>304</u>	UPL species <u>0</u>	x 5 = <u>0</u>	Column Totals: <u>221</u> (A)	<u>679</u> (B)	Prevalence Index = B/A = <u>3.07</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>30</u>	x 1 = <u>30</u>																			
FACW species <u>0</u>	x 2 = <u>0</u>																			
FAC species <u>115</u>	x 3 = <u>345</u>																			
FACU species <u>76</u>	x 4 = <u>304</u>																			
UPL species <u>0</u>	x 5 = <u>0</u>																			
Column Totals: <u>221</u> (A)	<u>679</u> (B)																			
Prevalence Index = B/A = <u>3.07</u>																				
<u>Sapling/Shrub Stratum</u> (Plot size: <u>30' diameter</u>)																				
1. <u>Rubus spectabilis</u>	15	x	FAC																	
2. <u>Sambucus racemosa</u>	5	x	FACU																	
3. _____																				
4. _____																				
5. _____																				
<u>20</u> = Total Cover																				
<u>Herb Stratum</u> (Plot size: <u>5' diameter</u>)				Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ 5 - Wetland Non-Vascular Plants ¹ ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
1. <u>Hedera helix</u>	1		FACU																	
2. <u>Carex obnupta</u>	30	x	OBL																	
3. <u>Polystichum munitum</u>	50	x	FACU																	
4. <u>Gaultheria shallon</u>	20	x	FACU																	
5. _____																				
6. _____																				
7. _____																				
8. _____																				
9. _____																				
10. _____																				
11. _____																				
<u>101</u> = Total Cover																				
<u>Woody Vine Stratum</u> (Plot size: _____)				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>																
1. _____																				
2. _____																				
<u>0</u> = Total Cover																				
% Bare Ground in Herb Stratum <u>0</u>																				
Remarks:																				

SOIL

Sampling Point: DP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-5	10YR 3/2	100					SCL	
5-12	10YR 2/2	100					SCL	
12								Root layer

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Large root layer
 Depth (inches): 12

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)

- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes No Depth (inches): _____
 Water Table Present? Yes No Depth (inches): _____
 Saturation Present? Yes No Depth (inches): _____
 (includes capillary fringe)

Wetland Hydrology Present? Yes No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Lincoln City 44-47th Connector City/County: Lincoln City Sampling Date: 10/12/23
 Applicant/Owner: Akana State: OR Sampling Point: DP-3
 Investigator(s): Jack Dalton and Racine Robinson Section, Township, Range: Sec 02, T7S, R11W
 Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 13
 Subregion (LRR): A-Northwest Forests and Coasts Lat: 44.595911 Long: -124.0974 Datum: NAD 83
 Soil Map Unit Name: (19E) Fenall-Winema silt loams, 15-35% slopes, Hydric rating = 0 NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u>30' diameter</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Alnus rubra</u>	80	x	FAC	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A) Total Number of Dominant Species Across All Strata: <u>4</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
2. _____				
3. _____				
4. _____				
	80	= Total Cover		
Sapling/Shrub Stratum (Plot size: <u>30' diameter</u>)				
1. <u>Rubus armeniacus</u>	10	x	FAC	Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____
2. <u>Rubus spectabilis</u>	20	x	FAC	
3. _____				
4. _____				
5. _____				
	30	= Total Cover		
Herb Stratum (Plot size: <u>5' diameter</u>)				
1. <u>Pteridium aquilinum</u>	5		FACU	Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> 5 - Wetland Non-Vascular Plants ¹ <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Polystichum munitum</u>	10		FACU	
3. <u>Carex obnupta</u>	85	x	OBL	
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
	100	= Total Cover		
Woody Vine Stratum (Plot size: _____)				
1. _____				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
2. _____				
	0	= Total Cover		
% Bare Ground in Herb Stratum <u>0</u>				
Remarks:				

SOIL

Sampling Point: DP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-14	10YR 2/1	100					CL	Muck-green and shiny blk
14-20	N 2.5/blk	90	SGY 5/1	10	C	M	CL	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes No Depth (inches): _____
 Water Table Present? Yes No Depth (inches): 9
 Saturation Present? Yes No Depth (inches): 1
 (includes capillary fringe)

Wetland Hydrology Present? Yes No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Lincoln City 44-47th Connector City/County: Lincoln City Sampling Date: 10/12/23
 Applicant/Owner: Akana State: OR Sampling Point: DP-
 Investigator(s): Jack Dalton and Racine Robinson Section, Township, Range: Sec 02, T7S, R11W
 Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 7
 Subregion (LRR): A-Northwest Forests and Coasts Lat: 44.595911 Long: -124.0974 Datum: NAD 83
 Soil Map Unit Name: (19E) Fenall-Winema silt loams, 15-35% slopes, Hydric rating = 0 NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

<u>Tree Stratum</u> (Plot size: <u>30' diameter</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Picea sitchensis</u>	10	x	FAC	Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A)
2. <u>Alnus rubra</u>	20	x	FAC	Total Number of Dominant Species Across All Strata: <u>4</u> (B)
3. _____				Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
4. _____				
	30	= Total Cover		
<u>Sapling/Shrub Stratum</u> (Plot size: <u>30' diameter</u>)				Prevalence Index worksheet:
1. <u>Rubus spectabilis</u>	35	x	FAC	Total % Cover of: _____ Multiply by: _____
2. <u>Sambucus racemosa</u>	T		FACU	OBL species _____ x 1 = _____
3. _____				FACW species _____ x 2 = _____
4. _____				FAC species _____ x 3 = _____
5. _____				FACU species _____ x 4 = _____
	35	= Total Cover		UPL species _____ x 5 = _____
<u>Herb Stratum</u> (Plot size: <u>5' diameter</u>)				Column Totals: _____ (A) _____ (B)
1. <u>Polystichum munitum</u>	2		FACU	Prevalence Index = B/A = _____
2. <u>Carex obnupta</u>	90	x	OBL	
3. _____				Hydrophytic Vegetation Indicators:
4. _____				<input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation
5. _____				<input checked="" type="checkbox"/> 2 - Dominance Test is >50%
6. _____				<input type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹
7. _____				<input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
8. _____				<input type="checkbox"/> 5 - Wetland Non-Vascular Plants ¹
9. _____				<input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain)
10. _____				¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
11. _____				
	92	= Total Cover		
<u>Woody Vine Stratum</u> (Plot size: _____)				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
1. _____				
2. _____				
	0	= Total Cover		
Remarks:				

SOIL

Sampling Point: DP-

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-6	10YR 2/2	100					SCL	
6-10	10YR 3/2	95	10YR 4/6	5	C	M	Sandy Loam	
10-14	10YR 2/2	95	10YR 3/6	5	C	M	SCL	
14-20	10YR 2/2	90	7.5YR 5/8	10	C	M	SCL	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____
 Depth (inches): _____

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes No Depth (inches): _____
 Water Table Present? Yes No Depth (inches): _____
 Saturation Present? Yes No Depth (inches): 16
 (includes capillary fringe)

Wetland Hydrology Present? Yes No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Oxidized rhizospheres along living roots begins at 6". saturation likely to be present closer to surface later in year - BPJ.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Lincoln City 44-47th Connector City/County: Lincoln City Sampling Date: 10/12/23
 Applicant/Owner: Akana State: OR Sampling Point: DP-5
 Investigator(s): Jack Dalton and Racine Robinson Section, Township, Range: Sec 02, T7S, R11W
 Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 7
 Subregion (LRR): A-Northwest Forests and Coasts Lat: 44.595911 Long: -124.0974 Datum: NAD 83
 Soil Map Unit Name: (19E) Fenall-Winema silt loams, 15-35% slopes, Hydric rating = 0 NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

VEGETATION – Use scientific names of plants.

<u>Tree Stratum</u> (Plot size: <u>30' diameter</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Alnus rubra</u>	80	x	FAC	Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A)
2. _____				Total Number of Dominant Species Across All Strata: <u>5</u> (B)
3. _____				Percent of Dominant Species That Are OBL, FACW, or FAC: <u>60</u> (A/B)
4. _____				
	80 = Total Cover			Prevalence Index worksheet:
<u>Sapling/Shrub Stratum</u> (Plot size: <u>30' diameter</u>)				Total % Cover of: _____ Multiply by: _____
1. <u>Rubus spectabilis</u>	20	x	FAC	OBL species _____ x 1 = _____
2. <u>Sambucus racemosa</u>	5	x	FACU	FACW species _____ x 2 = _____
3. _____				FAC species _____ x 3 = _____
4. _____				FACU species _____ x 4 = _____
5. _____				UPL species _____ x 5 = _____
	25 = Total Cover			Column Totals: _____ (A) _____ (B)
<u>Herb Stratum</u> (Plot size: <u>5' diameter</u>)				Prevalence Index = B/A = _____
1. <u>Carex obnupta</u>	50	x	OBL	Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ 5 - Wetland Non-Vascular Plants ¹ ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Polystichum munitum</u>	30	x	FACU	
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
	80 = Total Cover			
<u>Woody Vine Stratum</u> (Plot size: _____)				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
1. _____				
2. _____				
	0 = Total Cover			
% Bare Ground in Herb Stratum <u>20</u>				
Remarks:				

SOIL

Sampling Point: DP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-7	10YR 2/2	98	10YR 3/6	2	C	M	SCL	
7-14	10YR 3/2	95	10YR 5/8	5	D	M	SCL	
14-20	10YR 2/1	90	10YR 4/6	10	C	M	CL	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____
 Depth (inches): _____

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)

- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes No Depth (inches): _____
 Water Table Present? Yes No Depth (inches): 18
 Saturation Present? Yes No Depth (inches): 14
 (includes capillary fringe)

Wetland Hydrology Present? Yes No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Oxidized rhizospheres along Living Roots at 6". Saturation likely to be present later in year. - BPJ.
 Wetland boundary north of plot DP-5 - topo defined. Cover of salmonberry too dense to get additional upland data.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Lincoln City 44-47th Connector City/County: Lincoln City Sampling Date: 10/12/23
 Applicant/Owner: Akana State: OR Sampling Point: DP-6
 Investigator(s): Jack Dalton and Racine Robinson Section, Township, Range: Sec 02, T7S, R11W
 Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): _____ Slope (%): 20
 Subregion (LRR): A-Northwest Forests and Coasts Lat: 44.595911 Long: -124.0974 Datum: NAD 83
 Soil Map Unit Name: (19E) Fenall-Winema silt loams, 15-35% slopes, Hydric rating = 0 NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Hydric Soil Present?	Yes _____	No <input checked="" type="checkbox"/>	
Wetland Hydrology Present?	Yes _____	No <input checked="" type="checkbox"/>	
Remarks:			

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u>30' diameter</u>)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Alnus rubra</u>	<u>20</u>	<u>x</u>	<u>FAC</u>	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A) Total Number of Dominant Species Across All Strata: <u>5</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>60</u> (A/B)
2. <u>Sambucus racemosa</u>	<u>30</u>	<u>x</u>	<u>FACU</u>	
3. _____				
4. _____				
	<u>50</u>	= Total Cover		
Sapling/Shrub Stratum (Plot size: <u>30' diameter</u>)				Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____
1. <u>Sambucus racemosa</u>	<u>50</u>	<u>x</u>	<u>FACU</u>	
2. <u>Rubus spectabilis</u>	<u>20</u>	<u>x</u>	<u>FAC</u>	
3. _____				
4. _____				
	<u>70</u>	= Total Cover		
Herb Stratum (Plot size: <u>5' diameter</u>)				Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ 5 - Wetland Non-Vascular Plants ¹ ___ Problematic Hydrophytic Vegetation ¹ (Explain) <small>¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.</small>
1. <u>Carex obnupta</u>	<u>95</u>	<u>x</u>	<u>OBL</u>	
2. <u>Polystichum munitum</u>	<u>5</u>		<u>FACU</u>	
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
	<u>100</u>	= Total Cover		
Woody Vine Stratum (Plot size: _____)				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____
1. _____				
2. _____				
	<u>0</u>	= Total Cover		
% Bare Ground in Herb Stratum <u>0</u>				
Remarks:				

SOIL

Sampling Point: DP-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-20	10YR 2/2	95	10YR 4/6	3	C	M	SCL	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)
- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No Depth (inches): _____
 Water Table Present? Yes _____ No Depth (inches): _____
 Saturation Present? Yes _____ No Depth (inches): _____
 (includes capillary fringe)

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX C. SITE PHOTOGRAPHS



Photo 1: View east from southern tax lot boundary within southwestern area of site, showing existing conditions of cleared field.



Photo 2: View northeast of vegetation transition from upland field to plant community along the upland boundary of Wetland A.



Photo 3: View south of existing conditions and plant community of Wetland A within the southwest of the project area.



Photo 4: View north of mixed forest community onsite.



Photo 5: View east of existing conditions at Wetland B within the northeast of the project area.



Photo 6: View northeast of off-site storm water drainage pond that connects to the existing drainage within Wetland B.

APPENDIX D. HISTORIC AERIAL IMAGES

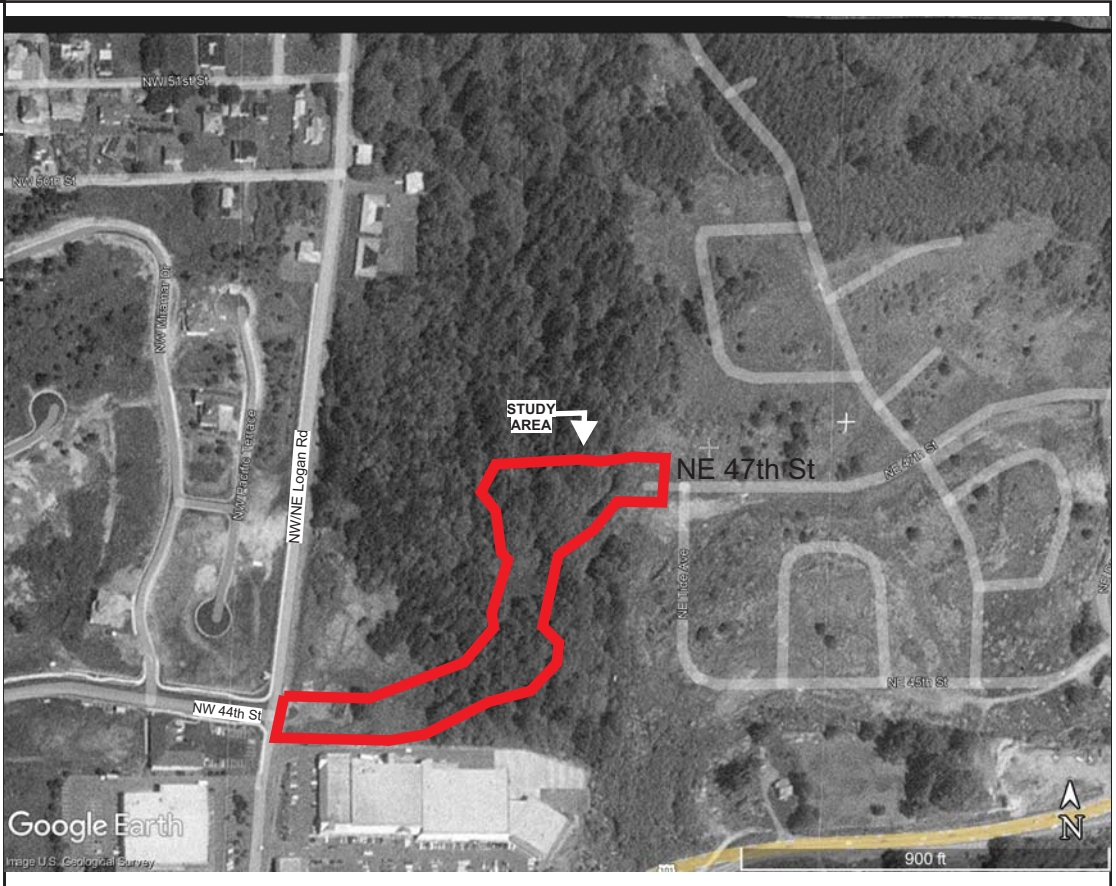
Historic Aerial Images I-5 & Butteville Road NE



Date: 05/05/1994

Source: GoogleEarthPro

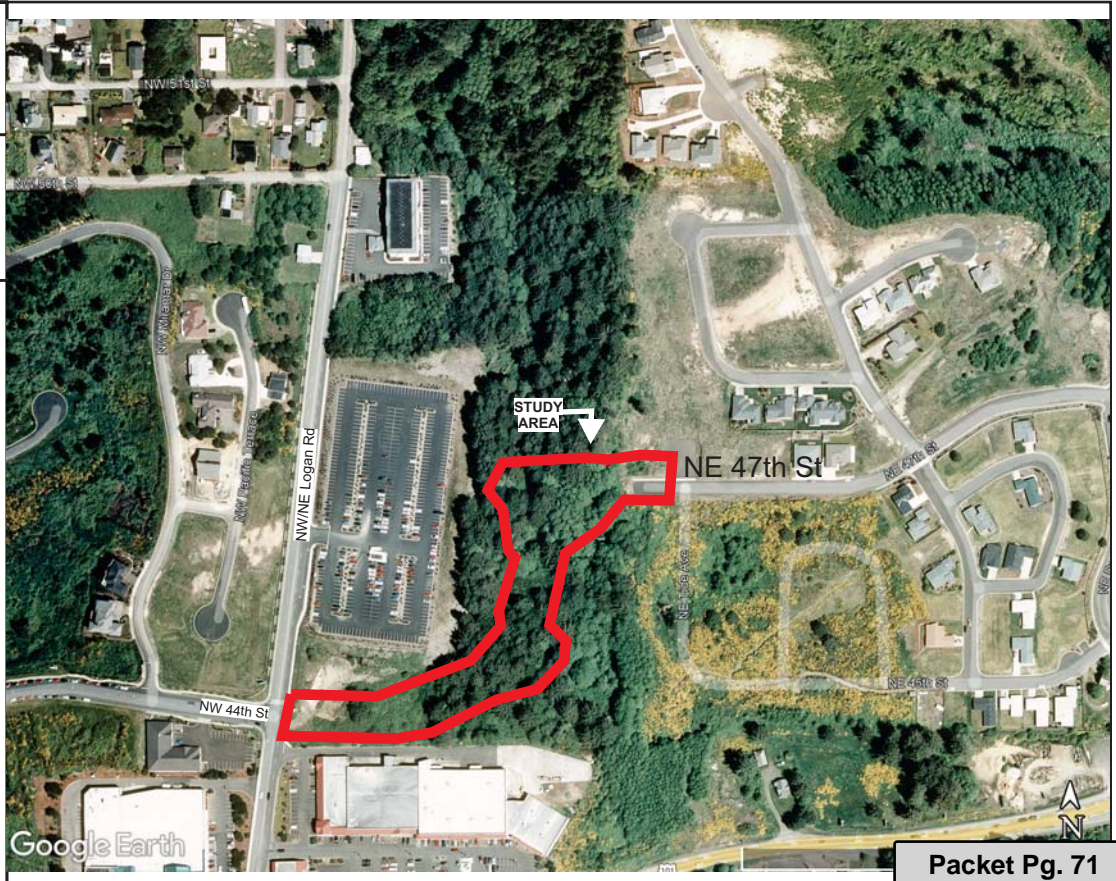
Oldest available aerial photo. No development on site.



Date: 02/18/2001

Source: GoogleEarthPro

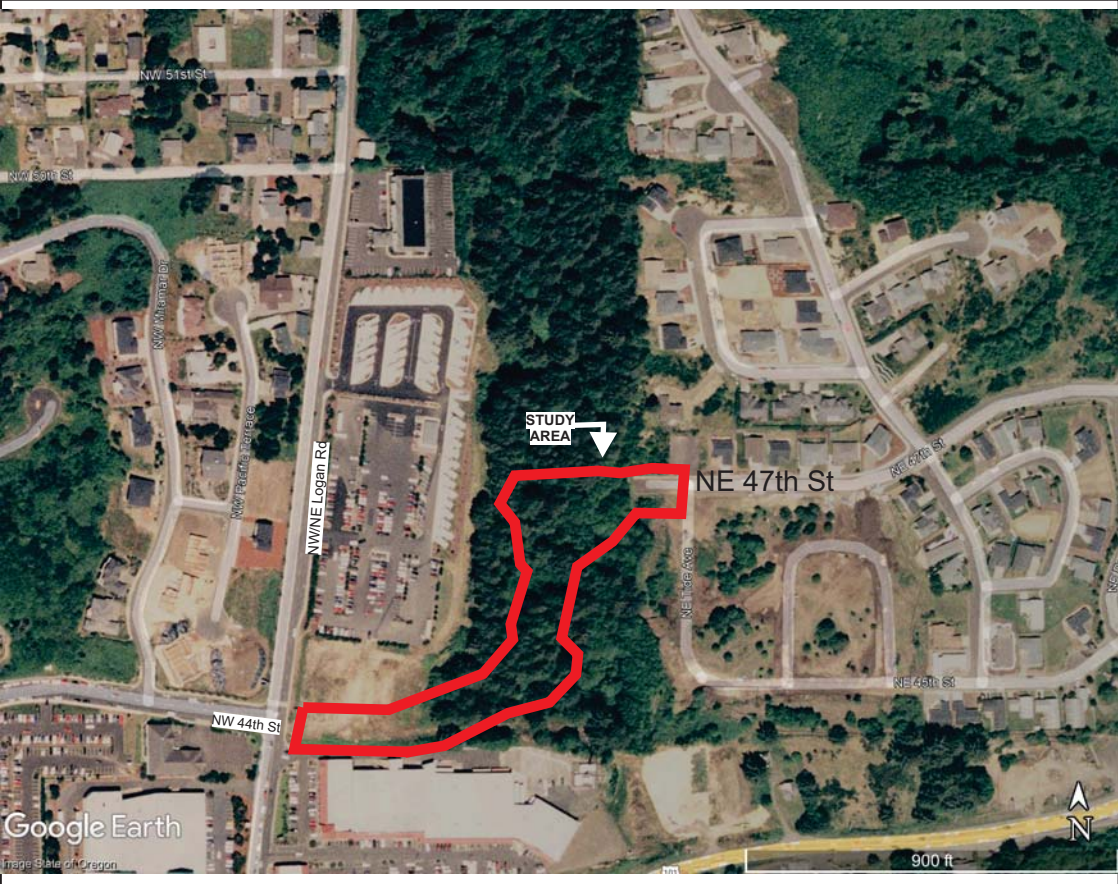
Parking lot developed to the west.



Date: 06/28/2005

**Source:
GoogleEarthPro**

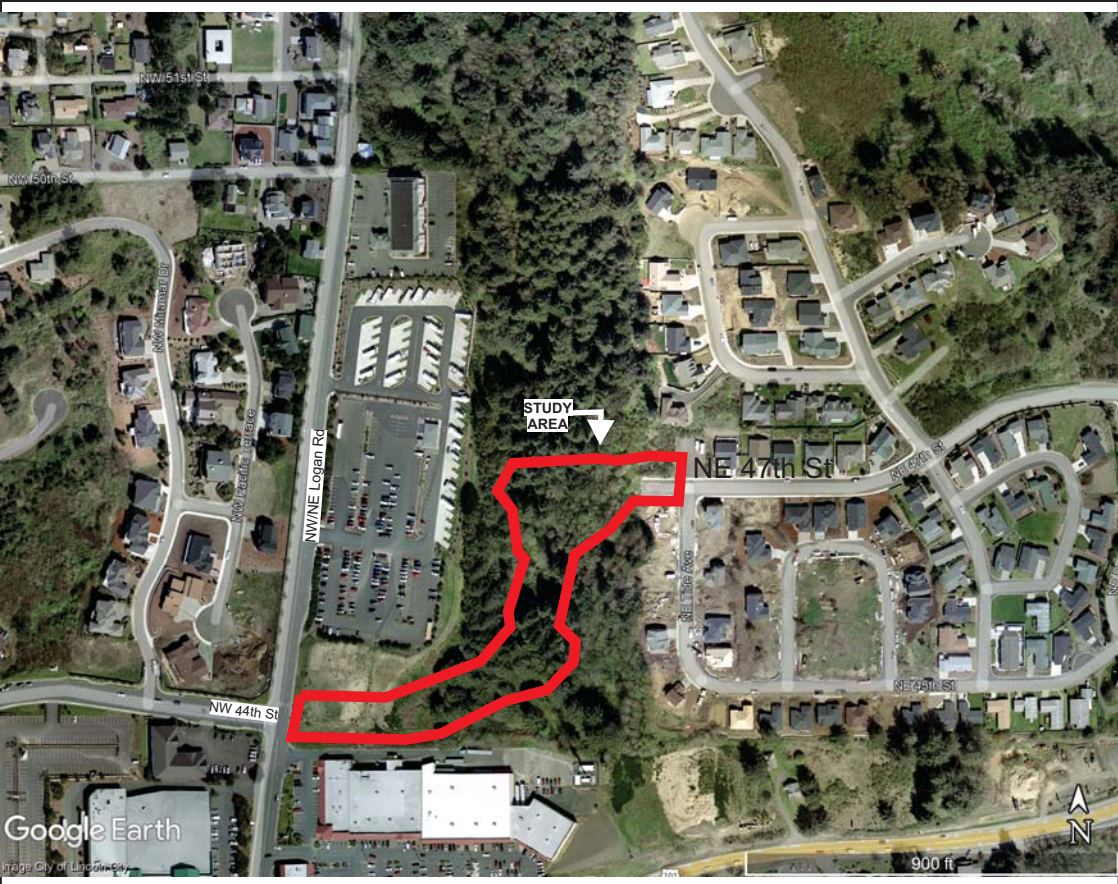
**Development in
eastern tax lot.**



Date: 04/04/2007

**Source:
GoogleEarthPro**

**Continued
development in
eastern tax lot.**

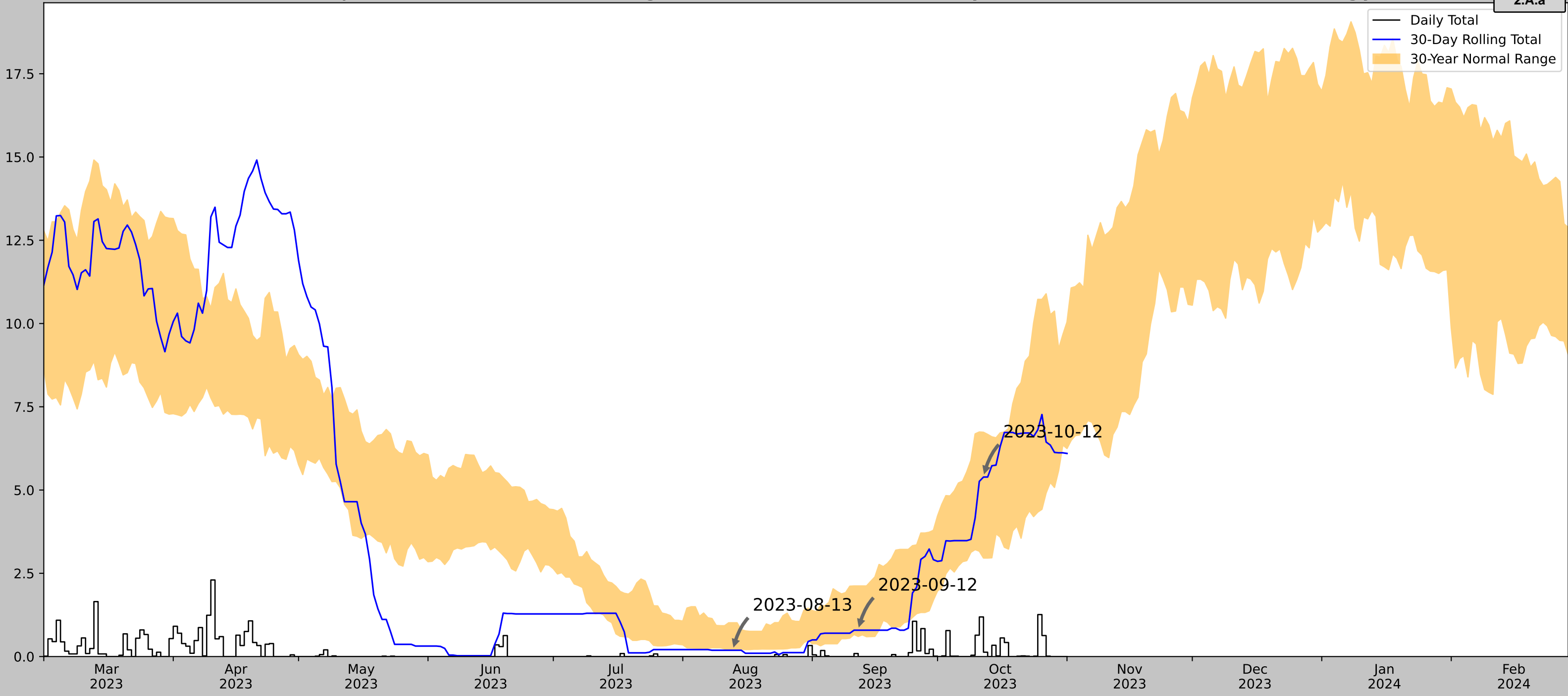


APPENDIX E. ANTECEDENT PRECIPITATION TOOL RESULTS

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network


2.A.a

Rainfall (Inches)




Coordinates	44.999753, -124.002706
Observation Date	2023-10-12
Elevation (ft)	66.058
Drought Index (PDSI)	Moderate drought (2023-09)
WebWIMP H ₂ O Balance	Wet Season

30 Days Ending	30 th %ile (in)	70 th %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-10-12	2.957874	6.73504	5.389764	Normal	2	3	6
2023-09-12	0.603937	2.119291	0.791339	Normal	2	2	4
2023-08-13	0.233858	1.01378	0.188976	Dry	1	1	1
Result							Normal Conditions - 11



Figures and tables made by the Antecedent Precipitation Tool Version 2.0

Developed by:
U.S. Army Corps of Engineers and
U.S. Army Engineer Research and Development Center



Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
OTIS 2 NE	45.0333, -123.9239	149.934	4.493	83.876	2.399	11273	78
LINCOLN CITY 0.7 NNW	44.982, -124.0142	96.129	5.659	53.805	2.851	2	0
LINCOLN CITY 1.0 SSW	44.9592, -124.0159	112.861	6.813	37.073	3.318	2	12
GLENEDEN BEACH 0.3 N	44.8849, -124.0345	50.853	11.592	99.081	6.365	8	0
CLOVERDALE	45.205, -123.8925	12.139	11.962	137.795	7.031	67	

APPENDIX F. REFERENCES

REFERENCES

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APPENDIX E
CULTURAL RESOURCES INVESTIGATION REPORT

(30 Pages)

Cultural Resources Survey of the NE 44th–47th Connector Project Area, Lincoln County, Oregon

Prepared for:

Akana
6400 SE Lake Rd #270
Portland, OR 97222

Prepared by:

Dana Holschuh, M.A., RPA

Submitted by:

Harris Environmental Group, Inc.
15800 Boones Ferry Road, Suite A6
Lake Oswego, OR 97035



November, 2023

Project No. HEG 23-042



Executive Summary

Purpose of the Survey: To assess the potential impacts of the proposed 44th–47th Connector project on any significant cultural resources identified within, or immediately adjacent to, the area of potential effects (APE) defined for the project in compliance with Section 106 of the National Historic Preservation Act (NHPA). The main objective of the project is to construct a connector street between the western terminus of NE 47th Street, and the eastern terminus of NW 44th Street, within the City of Lincoln City.

Summary of Findings: Harris Environmental has performed a literature review, and both surface (pedestrian) and sub-surface investigations within the 44th–47th Connector project area. The inventory consisted of a 100 percent pedestrian and shovel testing survey across the project area. The project was undertaken in September/October, 2023. The literature review revealed that there have been seven previous cultural resources surveys carried out in the vicinity, which have resulted in the recordation of two sites and one isolate. Harris Environmental therefore had low to moderate expectations of encountering archaeological deposits during the

During the survey, Harris Environmental excavated a total of eleven (11) shovel test probes (STPs) within the project area. No cultural materials or deposits were observed. Harris Environmental recommends a finding of No Historic Properties Affected. No further work is recommended, however the project proponents should work under an Inadvertent Discovery Plan for the duration of the project, such as that found at the end of this report.

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Project Description

The City of Lincoln City proposes to extend NE 47th Street to the intersection of NW 44th Street and NW Logan Road. The project is being coordinated by Akana, who contracted with Harris Environmental Group (Harris Environmental) to perform a cultural resources survey of the area of potential effects (APE) defined for the project.

The 44th – 47th Connector Project will require a permit from the U.S. Army Corps of Engineers (USACE). Any federal nexus triggers compliance with Section 106 of the National Historic Preservation Act (NHPA). Section 106 requires federal agencies to address any adverse effects of their projects on historic properties. The lead federal agency is responsible for initiating consultation with interested tribal governments pursuant to 36 CFR 800.2 (c)(2) and (3), determining the APE, and assessing impacts on any historic properties pursuant to 36 CFR Part 800.5(a)(1), 800.11, and 800.6. The purpose of this study is to identify any historic properties, including both archaeological resources and standing structures, which may be adversely affected by the proposed project, in accordance with 36 CFR 800.4.

The APE, hereafter referred to as the project area, for this project consists of the proposed corridor that connects the eastern terminus of NW 44th Street to the western terminus of NE 47th Street. It is entirely within the boundaries of Lincoln County Parcel # R229779, owned by the Confederated Tribes of Siletz Indians (Figure 2). This report details the results of the cultural resources investigation. The results of the background research, pedestrian and subsurface investigations are described below.

Area of Potential Effect

The area of potential effect, hereafter referred to as the project area, is in western, coastal Oregon, within the northern portion of Lincoln County. The project area consists of the proposed connector corridor (Figure 2). The corridor curves south from NE 47th Street at approximately 82 ft. above mean sea level (amsl). It descends a moderate to steep slope in its eastern portion to a lowest elevation of approximately 57 ft. amsl in the central portion. It then climbs the moderate slope of the western side to meet with the eastern terminus of NW 44th Street at approximately 128 ft. amsl. The corridor crosses a ravine landform that is largely characterized by wooded vegetation with a dense understory (Figures 2-6). In its western portion, the project area is characterized by a grassy slope with an eastern aspect (Figure 6).

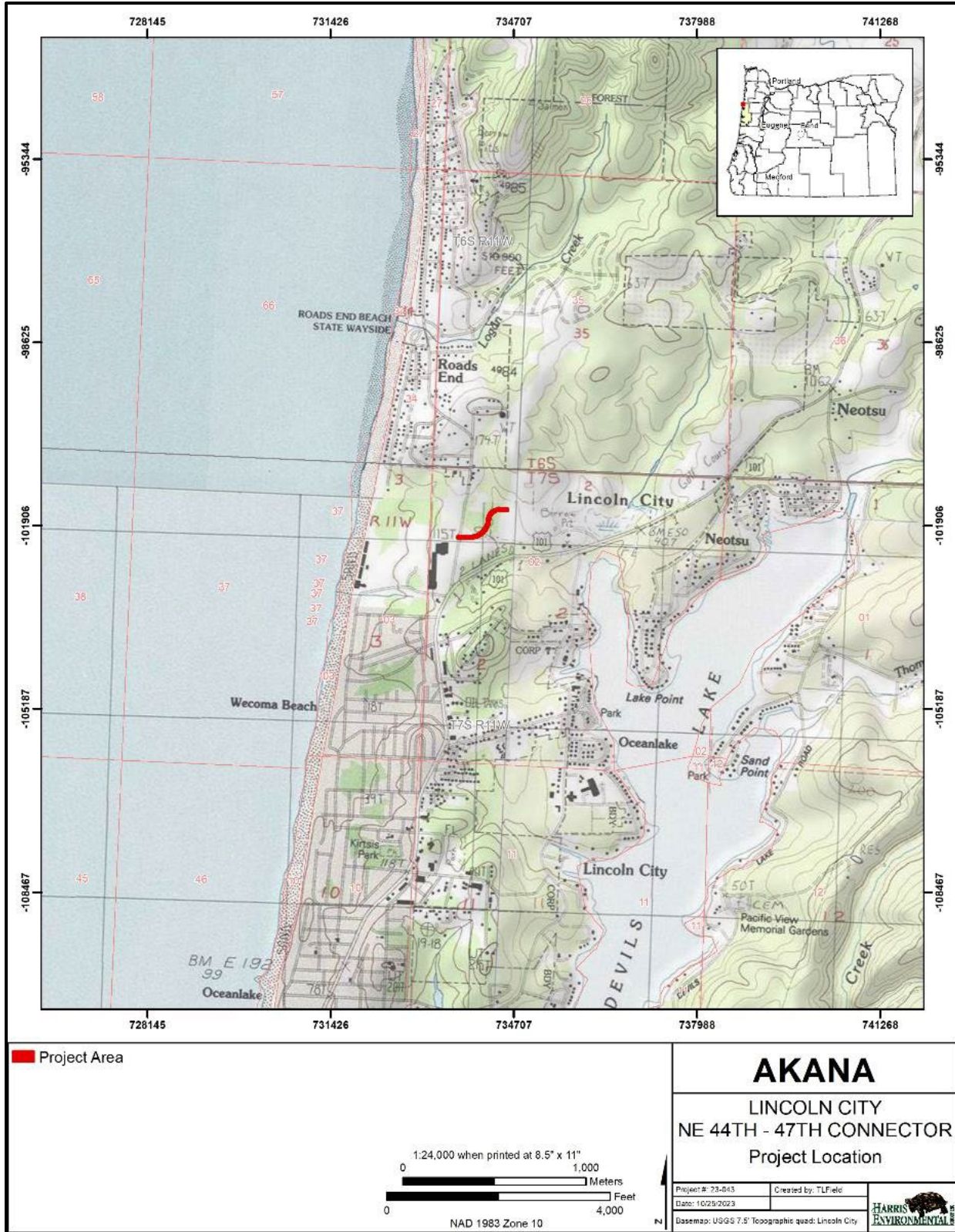


Figure 1. Overview of the 44th – 47th connector project area, on a portion of the Lincoln City, OR USGS topo map.

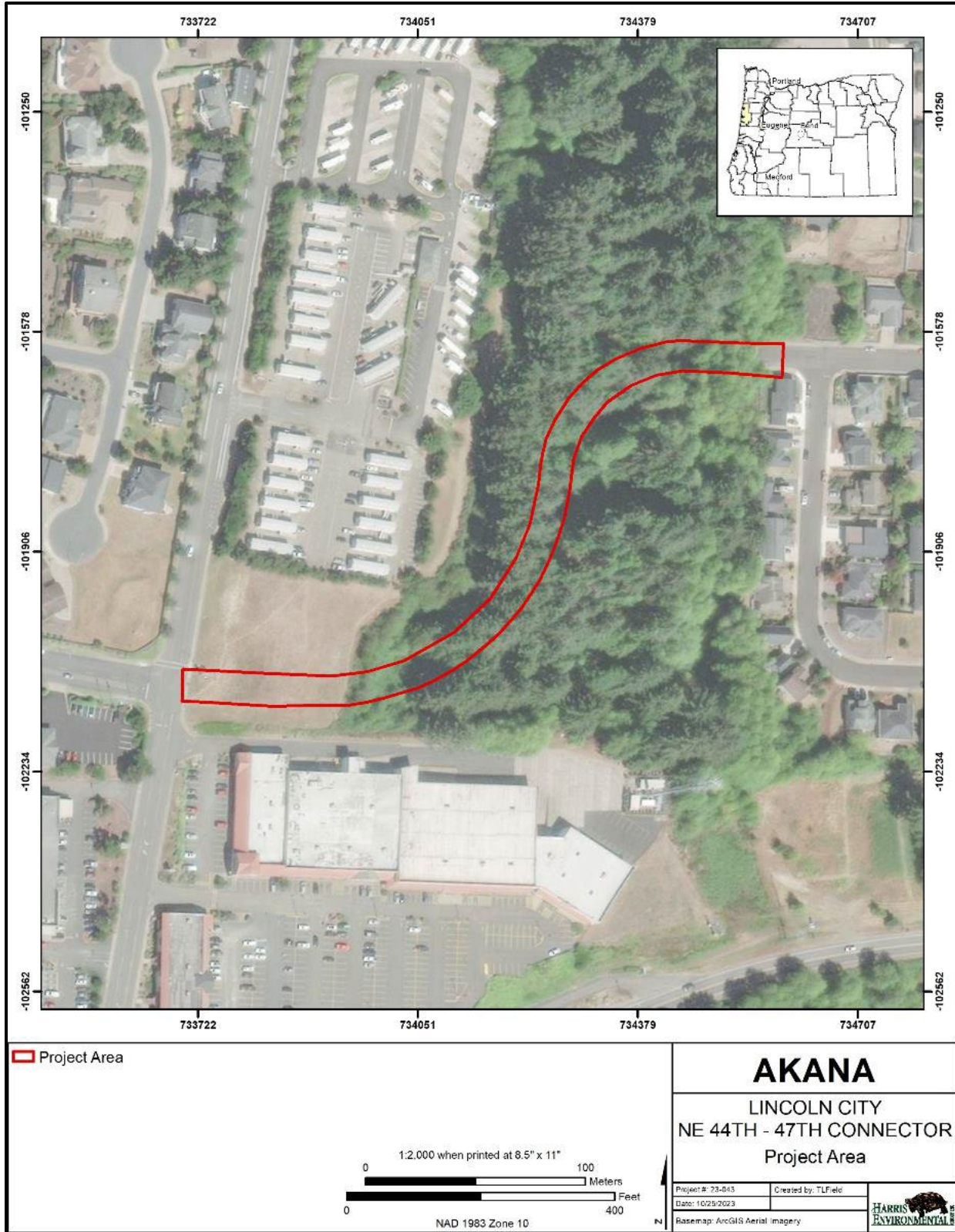


Figure 2. Aerial photomap, overlaid with the project area and existing conditions.



Figure 3. Photograph of project area in the vicinity of STP 1, looking east at dense vegetation.



Figure 4. Photograph of terrain and conditions in the vicinity of STP 4, looking northwest.

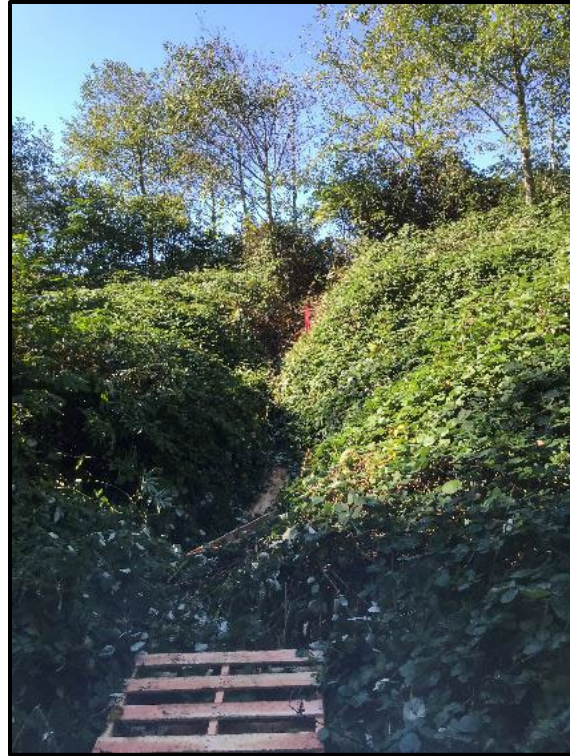


Figure 5. Photograph of slope of western side of project area, looking west.



Figure 6. Photograph of the western portion of the project area, looking east/southeast.



Environmental Setting

The project area is in the northern portion of Lincoln City, between the Pacific shoreline to the west and Devils Lake, to the east. Devils Lake is a 68-acre coastal lake formed approximately 14,000 years ago by uplifting of marine sediments and subsequent erosion (Devils Lake Water Improvement District 2011:7). The lake is fed by freshwater tributary streams flowing out of the Coast Range to the east and empties into the Pacific Ocean through the 120-m (400-ft) long D River.

Beginning around 66 million years ago, offshore volcanic activity created islands which, bolstered by subsequent volcanic activity resulting in basaltic pillow formation along the coast, as well as the influx of the Columbia River Basalt flows from the east, were pushed by tectonic forces into the continental shelf (Orr and Orr 2012). The resulting uplift carried these volcanic formations and the overlying and adjacent marine shelf deposits well above sea level, creating the Coast Range. By approximately 30 million years ago, these tectonic and volcanic forces stabilized, and while some localized uplifting continued during the Pliocene and Pleistocene, the primary geological forces acting on the Coast Range since have been sea level change and erosion.

The Project is on the north Oregon Coast at the transition between the Coast Range physiographic province and the Coastal Plain physiographic province. Moderate temperatures and heavy rainfall have resulted in the region's dense forest vegetation and mature soils. The Coast Range varies between 48 and 96 km (30 and 60 mi) in width between the Willamette Valley to the east and the Coastal Plain to the west and is characterized by moderately high mountains and coastal headlands extending approximately 320 km (200 mi) north to south. Geologically, the Coastal Plain is an extension of the Coast Range and consists of marine terraces along rivers and streams. The shoreline transitions between rocky headlands and broad sandy beaches. Bays and marshes have formed where the mouths of rivers have drowned at sea level (Franklin and Dyrness 1988; Hotze et al 2018).

Vegetation in vicinity of the project area consists of a forested environment. Sitka spruce (*Picea sitchensis*), shore pine (*Pinus Contorta*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*) are common within coastal plain forests. The understory consists of Pacific rhododendron (*Rhododendron macrophyllum*), evergreen huckleberry (*Vaccinium ovatum*), and salal (*Gaultheria shallon*) (Franklin and Dyrness 1988).

Soils within much of the project area is mapped as Fendall-Winema silt loam on 15-35 percent slopes. These soils developed from parent materials of colluvium and residuum and are found on hillslopes. In a typical profile, it consists of:

- *Ap* - 0 to 8 inches: medial silt loam
- *A* - 8 to 13 inches: silt loam
- *Bw1* - 13 to 17 inches: silty clay loam
- *Bw2* - 17 to 27 inches: paragravelly silty clay loam
- *BC* - 27 to 34 inches: very paragravelly silty clay loam
- *2Cr* - 34 to 44 inches: weathered bedrock



The western portion of the project area, where the terrain is less steep, is mapped as Fendall-Winema silt loam on 3 to 15 percent slopes. It is formed from parent material of colluvium derived from sedimentary rock. In a typical profile, it consists of:

- *H1 - 0 to 18 inches*: silt loam
- *H2 - 18 to 25 inches*: silty clay loam
- *H3 - 25 to 54 inches*: silty clay loam
- *H4 - 54 to 64 inches*: weathered bedrock (NRCS 2023).

Background Research

To establish a regional context for the project area, Harris Environmental carried out background research using many sources available from Oregon SHPO, the U.S. Forest Service, Harris Environmental's library, and online. Resources used included Oregon Archaeological Site Inventory files and cultural resource survey reports, General Land Offices (GLO) survey maps, various county road and other maps, as well as scholarly publications and other research materials.

Cultural Setting

Precontact Overview

As Toepel (1986) describes in the context of the Siuslaw National Forest, precontact sites, particularly excavated, stratified, and/or radiocarbon-dated sites, are notably few in the Oregon Coast Range and are typically limited to broad river valley bottoms and areas along the Pacific coast. Therefore, the following discussion of regional precontact archaeology draws primarily on archaeological data from coastal areas to the west and larger riverine systems north and south of the current project area.

Burtchard (1991) writes that western Oregon was climatically suitable for large game between 11,000 to 14,000 years before present (B.P.), and that humans were likely present in the area utilizing these resources. However, the coast and adjacent western flanks of the Coast Range are exposed to storms of the North Pacific and subject to a large degree of geological instability, leading to heavy erosion and shifting surfaces. In addition, large earthquakes and tsunamis that have struck the coast several times over the last millennia contributing to shifting stratigraphy and topographic flux. These natural forces lead both to the slow destruction of and catastrophic loss of archaeological sites (Erlandson and Moss 1999). Furthermore, until around 5,000 B.P., sea levels were consistently lower and it is assumed that peoples living on the coast and utilizing marine resources will have primarily left remnants in areas that have subsequently been inundated and are now located up to miles offshore. These factors have resulted in a dearth of Late Pleistocene and Early Holocene (approximately 14,000 – 7,500 B.P.) archaeological sites on the Oregon coast, to the extent that until relatively recently it was thought that coastal resources were not being exploited by native peoples until as late as 3,000 years B.P. A handful of older sites have since been discovered, but approximately 90% of recorded sites still date to within the last 1,500 years (Aikens et al. 2011). Evidence of human occupation on the southern Oregon Coast has now been reliably dated to 10,000 years B.P. at the Indian Sands shell midden site (35CU67) near Bandon,



approximately 85 miles (137 km) southwest of the current project area (Davis et al. 2002). The Tahkentich Landing site (35DO130) near Reedsport, approximately 48 miles (77 km) south-southwest of the current project area, has been dated to 8,000 years B.P. (Kirkpatrick 2019). However, both sites, while reliably dated within well preserved stratigraphic contexts, and containing large midden deposits of shell and bone, lack a diversity of cultural materials needed to draw broad conclusions about the lives of their inhabitants.

Apart from human coprolites discovered in south-central Oregon's Paisley Cave site dated to over 14,000 years B.P. (Gilbert et al. 2008), this earliest period of human occupation in western Oregon begins to reliably show archaeologically approximately 12,000 years ago with the discovery of a few isolated fluted projectile points scattered throughout the upper Willamette Valley (Aikens et al. 2011). These isolated fluted projectile point sites include the Lebanon Site, the Templeton Site, and the 1959 discovery of a waterworn fluted projectile along the Mohawk River in Lane County northeast of present-day Eugene (Minor and Pecor 1977). Similarly, a collector found two fluted points along the North Umpqua River, southeast of the current project area (Minor 1985). Peoples of this time are generally thought to have sustained relatively low, scattered populations of highly mobile hunter gatherers, travelling in small groups in pursuit primarily of larger game (Aikens et al. 2011).

Beyond isolated projectile finds, radiocarbon-dated sites from this early period of human occupation in Oregon, before the eruption of Mount Mazama around 7,700 B.P., are few. The Marial Site (35CU84) along the Rogue River in southwest Oregon has been dated to nearly 9,000 B.P. (Vincent 2013). This site contained hundreds of projectile points and was interpreted as a seasonal hunting camp occupied intermittently over 7,500 years. Another radiocarbon-dated site in western Oregon is Cascadia Cave, a stratified rockshelter site located next to the South Santiam River in the foothills of the Cascades, dating to as early as 7,900 B.P. (Pettigrew 1990). This rockshelter site, likely used on a seasonal basis by travelling hunter gatherers, produced a broad range of lithic debitage and stone tools, and contains notable rock art and petroglyphs.

Archaeological evidence from the Middle Holocene (7,500 to 3,000 B.P.) includes food processing oven features and associated charred camas bulbs, and the increased appearance of other plant foods such as hazelnuts and acorns (Aikens et al. 2011). Permanent winter habitations in low lying areas become increasingly evident in the archaeological record during this time. Various lithic artifacts for hunting, plant food processing and animal product processing were observed on sites from this period, and especially after 6,000 B.P., projectile point styles generally transition from larger leaf and side notched points to broad necked notched points (Minor and Pecor 1977). Ground stone implements also appear in site assemblages at this time, as diets became increasingly diversified, and as suggested by an increasing number of sites being found close to rivers, fishing became an increasingly important element of subsistence. One such well-studied site from this period is the Narrows Site, (35DO153), located along the North Umpqua River, contains stratified layers of occupation reaching back approximately 6,000 years and containing numerous flaked stone tools, groundstone implements for processing plant foods, a house pit, and a fragment of a baked clay figurine (O'Neill 1987). Several such sites in the lowland valleys from this period also indicate a close relationship with not just rivers but also wetlands, perhaps related to diet including an increasing diversity of waterfowl, fish, and small mammals, with many smaller sites observed



in locations subject to seasonal flooding. However, it is hypothesized that larger winter settlements sat on higher ground above flood levels (Aikens et al. 2011).

Sites observed dating to the Late Holocene (3,000 B.P. to Euro-American Contact) often present evidence of continuous or near-continuous occupation from approximately 3,000 years ago to the contact period (Aikens et al. 2011). An increasingly residential and centralized pattern of lifeways is established throughout western Oregon as evidenced by the development of plank houses and the accumulation of debris from continuous residential use appearing in stratified subsurface site deposits. Increasingly specialized subsistence is reflected in the proliferation of specialized food storage and processing features like camas roasting pits, subterranean storage pits, and bedrock mortars, the abundance of specialized technology like net weights and sinkers and fish weirs, and the growing use of controlled burning. Small projectile points such as the Gunther barbed style appear in the archaeological record demarcating the arrival of the bow and arrow into the late precontact hunter's toolkit. Numerous sites have been documented in the vicinity of Coos Bay from this period, and typical archaeological feature in the area include fish weirs, often found preserved below the ground surface in wet areas having dropped in elevation during seismic subsidence events, lithic scatters, and dense shell middens reflecting the increasingly strong reliance on marine resources (Minor and Nelson 2002). The Neptune site (35LA3), located on the coast south of Yachats, approximately 12.7 miles (20.4 km) due west of the current project area, is a stratified shell midden site which has been excavated in several episodes since 1973 and has yielded reliable radiocarbon dates spanning from 6,200 B.P. to 400 B.P. (Jenevein 2010). In addition to shell remnants and faunal remains (particularly of fish), the site has yielded a robust assemblage of lithic materials and fire cracked rock, and has yielded data illustrating relative shifts in diet and resource use in the Late Holocene.

Ethnographic Overview

The Project is within the traditional territory of the Salish-speaking Tillamook who occupied the Pacific coastline between Tillamook Head and the Siletz River. The Salmon River and Siletz bands, the southernmost subgroups of the Tillamook, occupied the territory within which the Project is located (Seaburg and Miller 1990). Anthropologists divide the Tillamook into subgroups based on cultural, geographical, and linguistic traits. Each subgroup had independent villages and the people were connected through intermarriage and trade. The villages within a subgroup shared cultural traits and a similar language.

The Tillamook occupied permanent villages typically located at the mouths of rivers and along bays (Sauter and Johnson 1974). The nearest village sites are recorded near the mouths of the Salmon and Siletz Rivers (Seaburg and Miller 1990). Houses consisted of rectangular post-and-plank structures that were either semi-subterranean or above ground. One or more hearths were built in the center, and ventilated through a smoke hole in the roof. Sleeping platforms and storage were located along the perimeter of the interior (Seaburg and Miller 1990). Houses were occupied by extended family groups.

The Tillamook hunted and gathered a variety of resources for food, shelter, tools, basketry, and clothing. Fish made up a large proportion of their diet. Fish were caught using weirs, basket traps,



gill nets, hook and line, harpoons, and gaffs (Sauter and Johnson 1974). Salmon, sturgeon, smelt, trout, and steelhead were harvested from the ocean and freshwater streams. Shellfish were also an important component of Tillamook subsistence as indicated by large shell middens associated with village sites.

Canoes were the primary mode of travel and were employed to access resources and surrounding villages (Jacobs 2003). Whales were opportunistically harvested on the occasion one washed up (Sauter and Johnson 1974). Although some seal and sea lions were apparently hunted, terrestrial hunting was focused along river valleys. Deer and elk provided large quantities of meat, hides for clothing, and bone, antler, and sinew for tools. Berries and other edible and medicinal plants were collected from Coast Range forests.

Historic Background

The first contact between native peoples and Euro-Americans in the coastal area, likely occurred sometime during 1693-1694 when the Spanish galleon Santo Cresto de Burgos wrecked on the Nehalem Spit approximately 75 km (47 mi) north of the Project. While Native peoples and Euro-American oral history suggests that survivors of the wreck and local native peoples interacted, the nature and duration of the relations remain unclear (Follett et al. 2018). Beginning in the late-1700s, European and Euro-American voyagers regularly explored the northern Oregon coastline by ship.

The Lewis and Clark expedition was the first overland expedition, arriving at the Oregon Coast in 1805, and overwintered at Fort Clatsop in the vicinity of Astoria. By the 1820s, fur trappers with the Hudson Bay Company were exploring the Oregon coastline. In 1849, Lieutenant Theodore Talbot dispatched from Fort Vancouver with a crew to explore the area and provided some of the first written accounts of the land and Native peoples in the Project's vicinity (Castle et al. 1978). Such early events enabled more intensive and aggressive Euro-American exploration, resource extraction, and eventually settlement near the project area and throughout the northwest.

In the 1850 coastal settlements and those to the east in the Willamette Valley, increased dramatically when the Donation Land Act passed. The Act provided one free square mile of land for married American citizens to settle in Oregon. Under the Act 7,347 settlers claimed 2.5 million acres of western Oregon including almost the entire Willamette Valley floor with complete disregard for indigenous people living in the area. This led to the explicit goal of seizing all native-held land in the Willamette Valley and the establishment of reservations to keep Native American inhabitants "out-of-sight, out-of-mind" (Minor et al. 1980).

Although successfully adapted to their own environments, between the late 1700s and mid-1800s the populations of Native peoples throughout Oregon were ravaged by European-borne diseases and epidemics that traumatized tribal individuals, families, and communities and distressed their traditional cultural patterns and resilience. The diseases came by land and seas along with European and Euro-American sailors on Spanish ships in 1775. Sailors interacted with Indians at the Trinidad and Quinault rivers about 402 km (250 mi) and 257 km (160 mi) to the south and north of Lincoln City, respectively (Wilkinson 2010).



There were substantial conflicts between Euro-American and tribal peoples, which led in 1855, to more than 4,000 Native peoples from 20 different Tribes being resettled on the 1.1-million-acre Siletz or Coast Indian Reservation, which extended 125 miles along the Oregon Coast between Cape Lookout and Tahkenitch Outlet. Euro-American demand for land and resources along the Oregon Coast motivated the federal government to steadily reduce these Trust lands throughout the mid- to late-1800s and into the early-1900s (Beckham 1990).

In 1887, the General Allotment Act was applied to the remaining Coast/Siletz Reservation, including the Project area, and was implemented in 1894. Tribal members received approximately 80 acres each of allotment lands in north Lincoln County. A year later the reservation was opened for Euro-American settlement. “Forced fee” policies moved most allotment lands to Non-Indian ownership by 1912. Restrictions against more than one 80-acre parcel being held in Trust by Siletz members meant lands were deeded and then either lost to taxes or sold, or mortgaged/foreclosed. The alternative was for the Siletz Agency to sell inherited allotment lands, which was often the case.

Euro-American development and homesteading was hampered by the steep, rocky, densely vegetated mountainous forest geography of the region, and a substantial amount of work was required to clear land as well as trails or roads to markets for agriculture. Lower lying areas on the coast and along creeks and rivers were more suitable for settlement and farming, and in such areas, homesteaders successfully raised sheep, and in coastal areas, dairying became profitable by the end of the 19th century. Logging, starting around settlements on the coast in the 19th century, and spreading rapidly into the interior with the arrival of logging railroads and better roads and vehicle technology in the early 20th century, was the primary industry in the vicinity of the project area.

Early Euro-American inhabitants of Lincoln County fished for salmon in the Siletz and Salmon Rivers. Small sawmills, canneries, and boat-builders supported the fishing industry (Moe and Fowler 1993). During the 1800s, the primary route to Lincoln City was the Grand Ronde and Coast Wagon Road. This route was used by Native peoples at the Grand Ronde reservation and by early Euro-American settlers to reach the coast (Lewis 2018).

In 1893, Lincoln County was established, splitting from Benton County. The first highways connecting north Lincoln County with surrounding areas spurred economic growth and expanded tourism. Highway 101, located to the south of the project area, was completed in the 1920s (Lincoln County Historical Society 2018). The Salmon River Highway was completed in 1930, providing a connection between the Willamette Valley and north Lincoln County (Lincoln County Historical Society 2018). The Salmon River Highway (now Highway 18) roughly follows the old Grand Ronde and Coast Wagon Road. Lincoln City, formerly Oceanlake, was incorporated in 1945. Oceanlake, Delake, Nelscott, Taft, and Cutler City were consolidated as Lincoln City in 1965 (Moe and Fowler 1993).

Harris Environmental also reviewed General Land Office (GLO), historic United States Geological Survey (USGS) topographical maps, and historic aerial photos to determine the range of possible historic cultural resources within the project area. The 1872 GLO plat of the project area, shows the division of land in the vicinity of the project area, but no ownership is attributed (GLO 1872). The 1903 GLO plat shows Devil’s Lake in its current configuration, but no ownership



or land division in the vicinity of the project area, which is labeled “Surveyed by John W. Meldrum in 1872” (GLO 1903). The 1930 Metsker Atlas of Lincoln County shows the project area within land attributed to Fred Freeman (Metsker 1930).

USGS topographic maps from 1941 onward show no development within the project area, which is depicted as a steep-sided canyon (USGS 1941, 1942, 1943, 1944, 1957, 1958, 1963, 1965, 1967, 1973, 1984, 1985, 1995, 2014, 2017, 2020). Aerial photos from 1971 show little development in the vicinity of the project area, which is entirely comprised of wooded acreage. Northeast Logan Road, to the west, is shown in its current configuration, but none of the development along that road has occurred (historicaerials 1971). Development along the road increased throughout the 1980s, and by the 1994 there has been increased roadway installation to the west and east, including roads that will comprise the residential development to the east. The shopping center to the south of the project area is shown on the 1994 photograph (historicaerials 1982, 1994). By 2000, the RV park and parking area at the western terminus of the project area is shown in its current position, and there has been progress on the roads within the development to the east (historicaerials 2000). The development on the eastern edge of the project area is complete and resembles its current configuration by the 2009 aerial (historicaerials 2009)

Previous Archaeology

Consultation with the Oregon Archaeological Records Remote Access (OARRA) web portal operated by the State Historic Preservation Office (SHPO) revealed that there have been at least seven (7) previous cultural resources surveys conducted within one mile (1.6 km) of the current project area (Table 1).

Table 1. Cultural Resources Surveys Previously Performed within One Mile of the Project Area

Title	Location (to project area)	Reference
Letter Report: Sewer Lines and Force Main, Lincoln City	within	Follansbee 1977
Road's End, Lincoln County, Oregon A Preliminary Cultural Resource Assessment	0.05 miles (0.07 km) W	Beckham 1975
US101: Shell Midden Context Statement, Columbia River to the California Border, MP 0.0 to MP 363.1, ADA-Accessible Ramps and Crossing Signal Pushbuttons Project	0.09 miles (0.15 km) S	Connolly et al. 2019
Archaeological Resource Identification for the State Parks Interpretive Project on the Oregon Coast	0.67 miles (1.06 km) N/NW	Minor 2017
Archaeological Survey of the Proposed Siletz Tribe Lakeside Village Housing Project, Lincoln City, Lincoln County, Oregon	0.72 miles (1.16 km) E	James 2007
Archaeological Survey of the Neachesna Village II Housing Development Project, Lincoln City, Oregon	0.72 miles (1.16 km) E	Hotze et al. 2018



Title	Location (to project area)	Reference
Exploratory Archaeological Survey of the U.S. Hwy 101 (West Devils Lake Road to Neotsu Drive) Sidewalk, Lincoln City, Oregon	0.72 miles (1.16 km) E	Connolly 2020

According to OARRA, there are three (3) archaeological sites and isolates that have been recorded within one mile of the project area. The closest of these is an archaeological isolate located during the survey of the Neachesna Village II Housing Development. The isolate was recorded within that report as a suspension disk insulator manufactured in 1959 (Hotze et al. 2018). There is no isolate form associated with the isolate and it was not assigned a trinomial (OARRA 2023).

Site number 35LN36, is located approximately 0.86 miles (1.39 km) to the west/southwest along the coastline. In 1975 the site was reported as “shell fragments visible in a bank” (Beckham 1975). There is no update for this form, and the ephemeral nature of its location, along with the development that has occurred since 1975 has likely resulted in its destruction. Site number 35LN3 is a large site located south of LN36 along the Oregon Coast, approximately .85 miles (1.36 km) to the southwest of the project area. There is no site form for this site, but the OARRA web portal describes the site as “Burial ground on original SHPO map but believed to be located to east on Oar Street.; Crest of Wacoma Heights, tombstones, found in 1938” (OARRA 2023). As indicated, tombstones were observed in 1938 to the southeast of the site’s boundaries and included in the site number (OARRA 2023).

Expectations

The results of the background research indicate that the project area is within a parcel that has not been developed and that the landform is favorable to native occupation and/or use. There have been seven (7) previous surveys carried out in the vicinity, resulting in the identification of two sites and one isolate. All of the sites/isolates are located at a remove from the project area and are not visible from the 44th–47th connector APE. The sites are recorded as a result of oral history, or early (ca. 1975) archaeological work, and it is reasonable to conclude that they do not retain integrity. Therefore, Harris Environmental had low to moderate expectations of encountering archaeological deposits within the project area during the surface and subsurface investigations.

Field Methodology

Harris Environmental performed the cultural resources inventory of the 44th–47th Connector project area on October 7, 2023 (Figure 7). Archaeologist Jacob Jordan performed the inventory, which consisted of pedestrian survey of the project area and the excavation of eleven (11) shovel test probes (STPs). All work was overseen by Dana Holschuh, M.A, RPA.

Pedestrian Survey

For the cultural resource inventory, Harris Environmental performed a 100 percent pedestrian survey of the proposed connector corridor, where the ground will be disturbed during the proposed

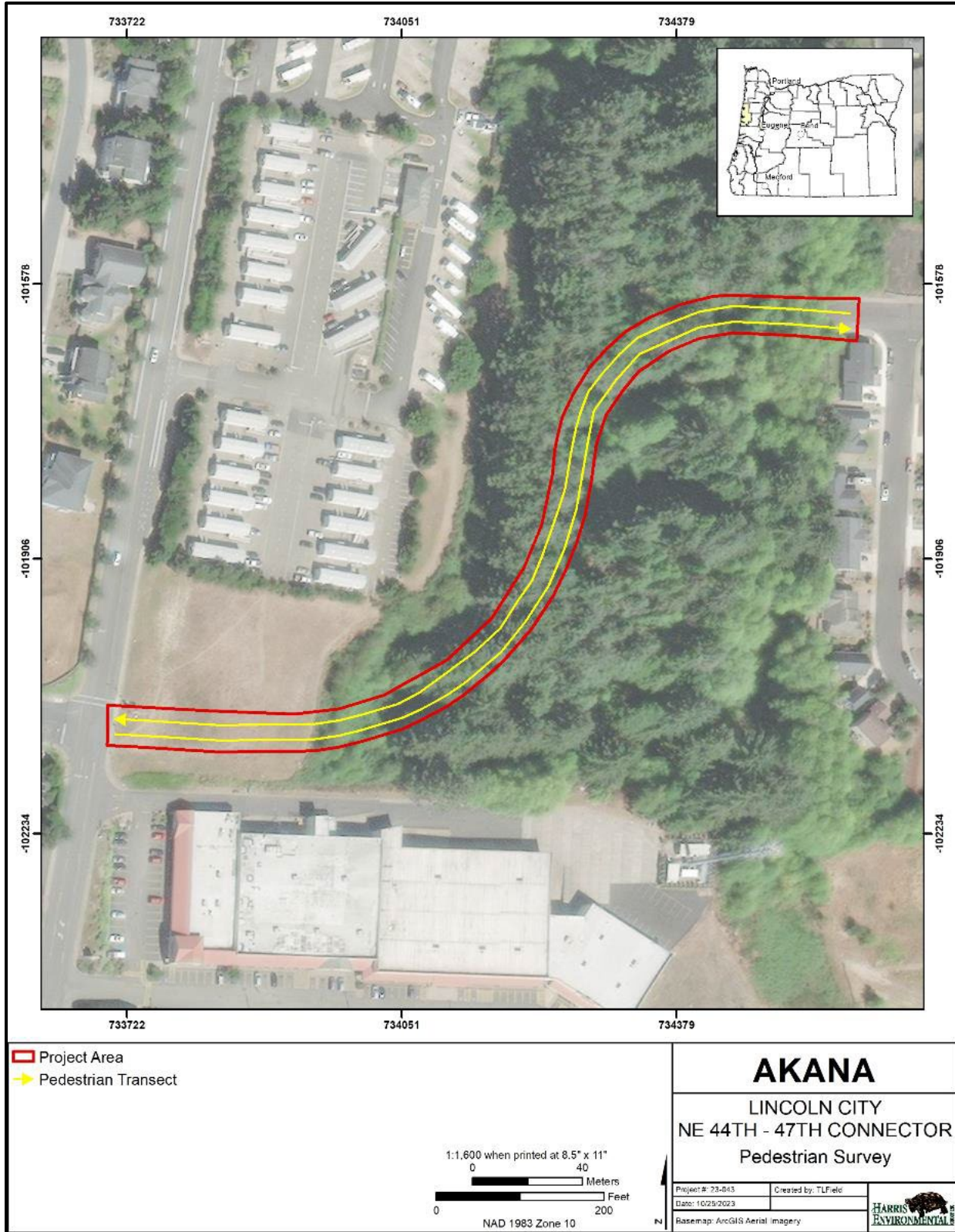


Figure 7. Aerial photomapping, overlaid with the approximate extent and orientation of the transects walked during the pedestrian survey.



project. All exposed soils were examined for cultural resources and signs of previous disturbances. Photographs were taken of the landforms within the project area (Figures 3-6). The pedestrian survey was also used to assess landforms for archaeological potential.

Harris Environmental walked the entirety of the landforms that comprise the project area, (Figure 7). All exposed soils were observed for cultural resources and signs of previous disturbances. Visibility within the project area was low, as most of the project area is moderately to densely vegetated and had leaf litter and other organic matter obscuring the ground surface. The western portion consisted of a grassy field, where visibility was slightly better, but still low (Figure 6).

Subsurface Investigation

Harris Environmental excavated a total of 11 STPs within the confines of the project area (Figure 8). The probes were excavated to determine whether subsurface cultural deposits are present within the proposed connector corridor. The probes were placed at approximately 30-meter intervals across the length of the proposed corridor. All STPs measured 35 cm in diameter and excavated to between 5 and 100 cm below surface (Table 2).

Excavation was done in approximately 10-cm levels, by hand using shovel and trowel. All material was passed through a 1/4-inch (6 mm) screen. Upon the completion, the soils were described and a GPS location was recorded for each probe. The holes were then immediately backfilled to return the landform to its original contour. The soils observed within each probe are given in Table 2, below.

Table 2. Soils observed within STPs excavated during subsurface investigation.

STP #	Depth (cmbs)	Soil Descriptions
1	0-100	Dark brown to black loosely compacted, silt with sand, 2% small gravels
2	0-48	Dark brown to black loosely compacted, silt with sand, 2% small gravels, large and small roots throughout
3	0-100	Dark brown to black loosely compacted, silt with sand, less than 1 % small gravels, small roots throughout
4	0-65	Dark brown to black loosely compacted, silt with sand, less than 1 % small gravels, small roots throughout
5	0-30	Dark brown to black loosely compacted, silt with sand, less than 1 % small gravels, small roots throughout
6	0-68	Dark brown to black loosely compacted, silt with sand, less than 1% small gravels, small roots throughout
	68-75	Tan, decaying bedrock
7	0-65	Dark brown to black loosely compacted, silt with sand, less than 1 % small gravels, small roots throughout
8	0-50	Dark brown to black loosely compacted, silt with sand, less than 1 % small gravels, small roots throughout
	50-62	Tan to yellow decaying bedrock
9	0-20	Dark reddish brown, highly compacted, silt with sand
	20-25	Tan to Yellow decaying bedrock
10	0-21	Dark reddish-brown silt with sand, highly compacted, 1 % gravels
11	0-5	Ended almost immediately after organics were removed, same sediment as STP 10

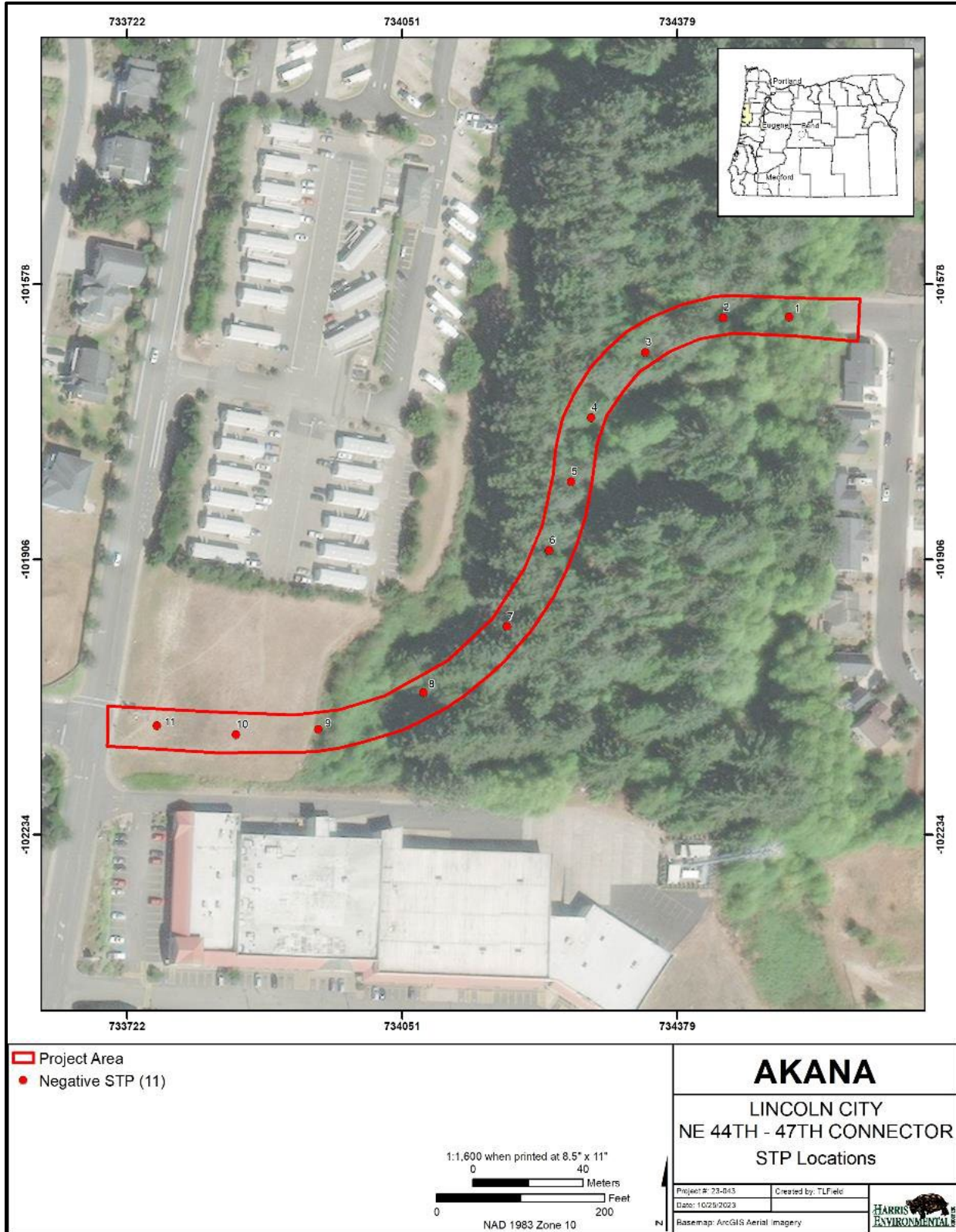


Figure 8. Aerial photomap overlaid with the location of the 11 STPs excavated during the subsurface investigation.



Figure 9. Soil profile observed in STP 9, at base of excavation.



Figure 10. Soil profile observed within STP 10, at base of excavation.



Results and Recommendations

Harris Environmental has performed a cultural resources inventory within the proposed 44th–47th Connector project area in the northern part of Lincoln City. This inventory consisted of a 100 percent pedestrian survey and a subsurface investigation.

Background research revealed that no previously identified sites or historic properties are located within the project area. During the pedestrian and subsurface investigations, Harris Environmental surveyed the entire project area, and excavated a total of 11 STPs. No cultural materials were observed during either the surface or subsurface investigations. Therefore, it is the recommendation of Harris Environmental Group that the proposed 44th–47th Connector project will have **no effect on any historic properties, including archaeological sites, listed on, or eligible for listing on, the National Register of Historic Places.**

Archaeological survey and investigation are based on sampling for potential cultural resources to infer the potential for cultural resources within the entirety of the project area. Although the potential is very low, there remains a possibility that unidentified archeological materials/resources exist in the project area, especially subsurface materials, or features. Therefore, if any cultural, historic, paleontological materials/resources, or human remains are encountered during the project planning or proposed construction activities, the Oregon SHPO must be contacted *immediately* in accordance with legislation regarding the *Protection of Historic Properties* [CFR Part 800. 13(b)] and *Inadvertent discoveries* [43 CFR 10.4(b-d)].



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Council Communication

Wastewater Feasibility Study

Meeting Date:	May 14, 2024	Primary Staff Contact:	Daphnee Legarza
Department:	City Council	E-Mail:	DLegarza@lincolncity.org
Secondary Dept:		Secondary Contacts:	
Approval:	Daphnee Legarza	Estimated Time:	30 minutes

Background

On June 30, 2020 the City received a new National Pollutant Discharge Elimination System (NPDES) Permit from the Department of Environmental Quality (DEQ). HBH Consulting Engineers was selected to prepare a report to evaluate the treatment facility for compliance with the new permit. This evaluation is required by the Compliance Schedule in Schedule C of the City's NPDES Permit #101122 dated June 30, 2020.

The report, titled "Wastewater Feasibility Study: Alternative Solutions for Reduction in Temperature, Cooper & Zinc" was completed October 2021.

The recommended actions were for the City to move forward with relocating the current outfall to the Ocean. The City should begin the permitting process including a new mixing zone study and determine the most reasonable alignment for a transmission line.

The City must have achieved full compliance with the final permit limits by December 1, 2037 (13 and ½ years from now).

The Wastewater Feasibility Study with attachments is attached to this communication.

Attachments:

Lincoln City Feasibility Study_optimized (PDF)



501 E First Street
Newberg, Oregon 97132
(503) 554-9553 - Fax (503) 537-9554

Date: **October 8, 2021** Project Number: **2019-019.03**

To: **Stephanie Reid, Public Works Director**
City of Lincoln City
PO Box 50
Lincoln City, OR 97367

From: **Matthew Del Moro, PE & Andrey Chernishov, PE**

RE: **Wastewater Feasibility Study: Alternative Solutions for Reduction in Temperature, Copper, & Zinc**
DEQ File No. 50677, NPDES Permit No. 101122

The following is an evaluation of the wastewater treatment facility in the City of Lincoln City in Lincoln County. This evaluation is required by the Compliance Schedule in Schedule C of the National Pollutant Discharge Elimination System (NPDES) Permit #101122 dated June 30, 2020.

The purpose of this evaluation is to assist the City of Lincoln City with guidance for making decisions needed to meet the requirements of the NPDES permit issued by the Oregon Department of Environmental Quality (DEQ). Specifically, this study is intended to evaluate alternatives to address new permit limits for Excess Thermal Load, Total Recoverable Copper, and Total Recoverable Zinc issues relating to changes to the City’s NPDES permit compliance schedule.

Project Location

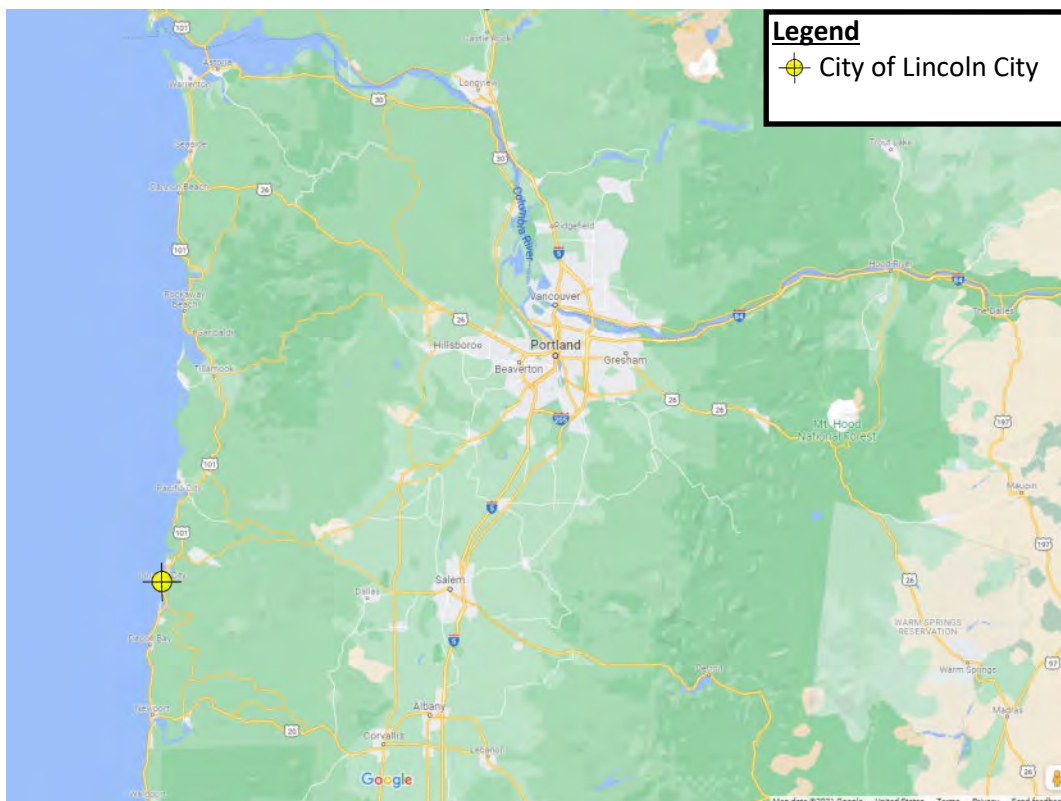


Figure 1 – Project Location Map

Reference Documents

The following documents are used in the composition of this study:

- *City of Lincoln City Wastewater Facilities Plan* MWH/Richwine Environmental, 2004
- *Mixing Zone Study for the City of Lincoln City, OR*, Kennedy/Jenks Consultants, 2016
- NPDES Permit #101122 and attachments, Oregon DEQ, June 30, 2020

Regulatory Requirements

In 2003, EPA Region 10 issued the Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. The Oregon Environmental Quality Commission created and adopted the current water temperature standard in 2003. The standards were established in order to protect, maintain, and restore coldwater salmonoid populations to healthy levels. The Oregon standard was revised and approved by EPA in February 2011. Oregon's current Temperature Standard Rule is defined in OAR 340-041-0028. Section 12(b) for the implementation of temperature criteria defines an authorization for human use as insignificant additions of heat in waters exceeding the applicable temperature criteria as follows:

- A. Prior to the completion of the temperature TMDL or other cumulative effects analysis, no single NPDES point source that discharges into a temperature water quality limited water may cause the temperature of the water body to increase more than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after mixing with either twenty-five (25) percent of the stream flow, or the temperature mixing zone, whichever is more restrictive; or
- B. Following a temperature TMDL or other cumulative effects analysis, waste load and load allocations will restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after complete mixing in the water body, and at the point of maximum impact.
- C. Point sources must be in compliance with the additional mixing zone requirements set out in OAR 340-041-0053(2)(d).
- D. A point source in compliance with the temperature conditions of its NPDES permit is deemed in compliance with the applicable criteria.

Kennedy Jenks completed a mixing zone study in 2016, which is included as Attachment 1.

NPDES Permit

Oregon Department of Environmental Quality issued a new NPDES Permit on June 30, 2020, with an effective date of August 1, 2020. The expiration of the permit is June 30, 2025. The permit is included in Attachment 2.

Permit Limits

Table 1 Shows the Schedule A permit waste discharge limits for the Effluent Outfall 001:

Table 1 – NPDES Permit Limits for Outfall 001 (Table A1)

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD ₅ (May 1 – October 31)	mg/L	10	15	
	lbs/day	250	380	500
	% removal	85		
TSS (May 1 – October 31)	mg/L	10	15	
	lbs/day	250	380	500
	% removal	85		
BOD ₅ (November 1 – April 30)	mg/L	20	30	
	lbs/day	750	1100	1500
	% removal	85		
TSS (November 1 – April 30)	mg/L	20	30	
	lbs/day	750	1100	1500
	% removal	85		
pH	SU	Instantaneous limit between a daily minimum of 6.2 and a daily maximum of 9.0		
Fecal Coliform (marine and estuarine shellfish growing waters) See note a.	#/100 mL	Interim limit = Must not exceed 126 organisms monthly geometric mean and no single sample shall exceed 406 organisms per 100 mL. Final limit = Must not exceed a monthly median of 56 organisms per 100 mL, not more than 10% of the samples collected in a calendar month may exceed 172 organisms per 100 mL.		
Total Ammonia Nitrogen	mg/L	5.3		12.2
Excess Thermal Load See note b.	Million kcal/day	Interim limit = 31 as a 7-day rolling average Final limit = 10.7 as a 7-day rolling average		
Total Recoverable Copper See note c.	µg/L	1.8		3.1
Total Recoverable Zinc See note d.	µg/L	37.1		64.3
Notes: a. The interim fecal coliform bacteria limit will become effective upon permit issuance. The final fecal coliform bacteria limit shall become effective after completion of the compliance schedule in SCHEDULE C. While under the interim limit, if a single sample exceeds 406 organisms per 100 mL, five consecutive re-samples may be taken at intervals between two and four hours beginning 28 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation of the interim limit will not be triggered. b. The interim Excess Thermal Load Limit will become effective upon permit issuance. The final Excess Thermal Load limit will become effective after completion of the compliance schedule in Schedule C. c. The Total Recoverable Copper limit will become effective upon completion of the compliance schedule in Schedule C. d. The Total Recoverable Zinc limit will become effective upon completion of the compliance schedule in Schedule C.				

Mixing Zone: The regulatory mixing zone for Outfall 001 is described as follows:

The allowable mixing zone is that portion of Schooner Creek within a band extending out twenty (20) feet from the point of discharge and extending two hundred (200) feet upstream and downstream from the point of discharge. The Zone of Immediate Dilution (ZID) shall be defined as the portion of the allowable mixing zone that is within twenty (20) feet of the point of discharge.

Table 2 shows the Schedule A permit limits for Recycled Water Outfall 002:

Table 2 – NPDES Permit Limits for Recycled Water Outfall 002 (Table A2)

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
A	<p>Class A recycled water must be oxidized, filtered and disinfected.</p> <p>Before disinfection, unless otherwise approved in writing by DEQ, turbidity may not exceed:</p> <ul style="list-style-type: none"> • An average of 2 NTUs within a 24-hour period. • 5 NTUs more than five percent of the time within a 24-hour period. • 10 NTUs at any time. <p>After disinfection, total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 2.2 organisms per 100 mL based on daily sampling over the last 7 days that analyses have been completed. • 23 organisms per 100 mL in any single sample. 	<p>Class A recycled water may be used for:</p> <ul style="list-style-type: none"> • Classes B, C, and D, and nondisinfected uses. • Irrigation for any agricultural or horticultural use. • Landscape irrigation of parks, playgrounds, school yards, residential landscapes, or other landscapes accessible to the public. • Commercial car washing or fountains when the water is not intended for human consumption. • Water supply source for non-restricted recreational impoundments.
B	<p>Class B recycled water must be oxidized and disinfected. Total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 2.2 organisms per 100 mL, based on the last 7 days that analyses have been completed. • 23 total coliform organisms per 100 mL in any single sample. 	<p>Class B recycled water may be used for:</p> <ul style="list-style-type: none"> • Class C and D, and nondisinfected uses. • Stand-alone fire suppression systems in commercial and residential building, non-residential toilet or urinal flushing, or floor drain trap priming. • Water supply source for restricted recreational impoundments.
C	<p>Class C recycled water must be oxidized and disinfected. Total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 23 total coliform organisms per 100 mL, based on results of the last 7 days that analyses have been completed. • 240 total coliform organisms per 100 mL in any two consecutive samples. 	<p>Class C recycled water may be used for:</p> <ul style="list-style-type: none"> • Class D and nondisinfected uses. • Irrigation of processed food crops; irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil. • Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses. • Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural firefighting using aircraft, street sweeping, or sanitary sewer flushing.
D	<p>Class D recycled water must be oxidized and disinfected. E. coli may not exceed:</p> <ul style="list-style-type: none"> • A 30-day geometric mean of 126 organisms per 100 mL. • 406 organisms per 100 mL in any single sample. 	<p>Class D recycled water may be used for:</p> <ul style="list-style-type: none"> • Nondisinfected uses. • Irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals.
Non-disinfected	<p>Nondisinfected recycled water must be oxidized.</p>	<p>Nondisinfected water may be used for:</p> <p>Irrigation for growing commercial timber, fodder, fiber or seed crops not intended for human ingestion.</p>

Table 3 shows the Schedule A permit limits for Biosolids.

Table 3 – NPDES Permit Biosolids Limits (Table A3)

Pollutant See note a.	Ceiling concentrations (mg/kg)	Pollutant concentrations (mg/kg)	Cumulative pollutant loading rates (kg/ha)
Arsenic	75	41	41
Cadmium	85	39	39
Copper	4300	1500	1500
Lead	840	300	300
Mercury	57	17	17
Molybdenum	75	N/A	N/A
Nickel	420	420	420
Selenium	100	100	100
Zinc	7500	2800	2800

Note:
 a. Biosolids pollutant limits are described in 40 CFR 503.13, which uses the terms *ceiling concentrations*, *pollutant concentrations*, and *cumulative pollutant loading rates*.

The following also applies to biosolids:

The permittee may land apply biosolids or provide biosolids for sale or distribution, subject to the following conditions:

- The permittee must manage biosolids in accordance with its DEQ-approved Biosolids Management Plan and Land Application Plan.
- The permittee must apply biosolids at or below the agronomic rates approved by DEQ in order to minimize potential groundwater degradation.
- The permittee must obtain written site authorization from DEQ for each land application site prior to land application (see Schedule D) and follow the site-specific management conditions in the DEQ-issued site authorization letter.
- Prior to application, the permittee must ensure that biosolids meet one of the pathogen reduction standards under 40 CFR 503.32 and one of the vector attraction reduction standards under 40 CFR 503.33.
- The permittee must not apply biosolids containing pollutants in excess of the ceiling concentrations shown in the table below. The permittee may apply biosolids containing pollutants in excess of the pollutant concentrations, but below the ceiling concentrations, however, the total quantity of biosolids applied cannot exceed the cumulative pollutant loading rates in the table above.

NPDES Compliance Schedule

Table 1-4 shows the Schedule C compliance schedule.

Table 4 – NPDES Permit Fecal Coliform Compliance Schedule (Table C1)

Complete By:	Requirement:
February 15, 2021 and annually thereafter	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final fecal coliform effluent limits.
December 31, 2023	Submit a plan for coming into compliance with the fecal coliform final effluent limits to DEQ for approval.
June 30, 2024	Secure financing for improvements to comply with the fecal coliform final effluent limits.
December 31, 2024	Submit plans for improvements to comply with the fecal coliform final effluent limits.
September 30, 2025	Complete improvements and meet the fecal coliform final effluent limits included in Schedule A.

Table 5 – NPDES Permit Total Recoverable Copper, Total Recoverable Zinc, and Excess Thermal Load Compliance Schedule (Table C2)

Complete By:	Requirement:
February 15, 2021, and annually thereafter	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final effluent limits.
December 31, 2028	Complete a Facility Plan that selects options for improvements to the treatment facility to comply with the copper, zinc, and Excess Thermal Load final effluent limits and submit the Facility Plan to DEQ for review and approval.
December 31, 2031	Evaluate and obtain financing for wastewater facility improvements recommended in the Facility Plan.
December 31, 2032	Complete Preliminary Design Report and submit to DEQ for review and approval.
December 31, 2033	Complete Final Design and submit to DEQ for review and approval.
October 31, 2037	Complete construction of wastewater facility improvements to comply with the copper, zinc, and Excess Thermal Load final effluent limits.
December 1, 2037	The permittee must achieve compliance with the final effluent limits and provide DEQ with written notice of compliance with the copper, zinc, and Excess Thermal Load final effluent limits in Schedule A.

Existing WWTP

The following is a brief description of the existing wastewater treatment plant (WWTP). Figure 2 details the Wastewater Treatment Plant site layout. The wastewater system has the following components:

Collection System: The collection system utilizes gravity feed sewer mains to collect residential, commercial, and industrial waste. This waste is delivered to trunk and interceptor lines before being delivered to pump stations. There are 30 pump stations making up 26 pump station basins within the City. One of the pump stations is privately owned and maintained and delivers waste from the Factory Outlet Stores. All flows from the collection system pass through the Nelscott, 48th & Jetty, or the Spyglass pump stations before being delivered to the Wastewater Treatment Plant (WWTP). The collection system is not analyzed in this study.

WWTP Influent & Screening: Flows from the collection system enters the treatment plant through a 24" influent pipe and passes through one of two bar screens. Screenings are collected below the screens in a dumpster and taken to the landfill for disposal.

Grit Removal: Two 8'x8' detritus tanks are used for grit collections. Collected grit is discharged to dumpsters for storage and eventual landfill disposal.

SBR Basins: Influent flow is divided between four sequencing batch reactors (SBR) in parallel for solids separation. Solids removed are sent to the Aerobic Digestors while the effluent is moved to cloth media filters.

Filtration Process: From the SBRs, wastewater is delivered through two AquaAerobics Cloth-Media Disk Filters in parallel. Each filter unit has twelve disks with an area of 53.8 square feet per disk.

Disinfection: There are two separate horizontal open channels for UV disinfection each containing two UV banks. Fixed finger-type weirs are used for channel level control.

Aerobic Digester: Waste Activated Sludge (WAS) from the SBR basins is delivered to two aerobic digesters operated in series. The digesters are 80 ft in diameter with a maximum capacity of 0.56 million gallons and a designed solids loading rate of 4,640 lbs VS/day (dry solids).

Facultative Lagoons: The City utilizes facultative lagoons to provide long term storage of aerobically digested biosolids. Lagoons are able to provide sufficient detention time to meet Class B biosolids requirements.

Outfall: Treated and disinfected effluent flows through a mostly 36-inch pipe to the outfall on the bank of Schooner Creek.

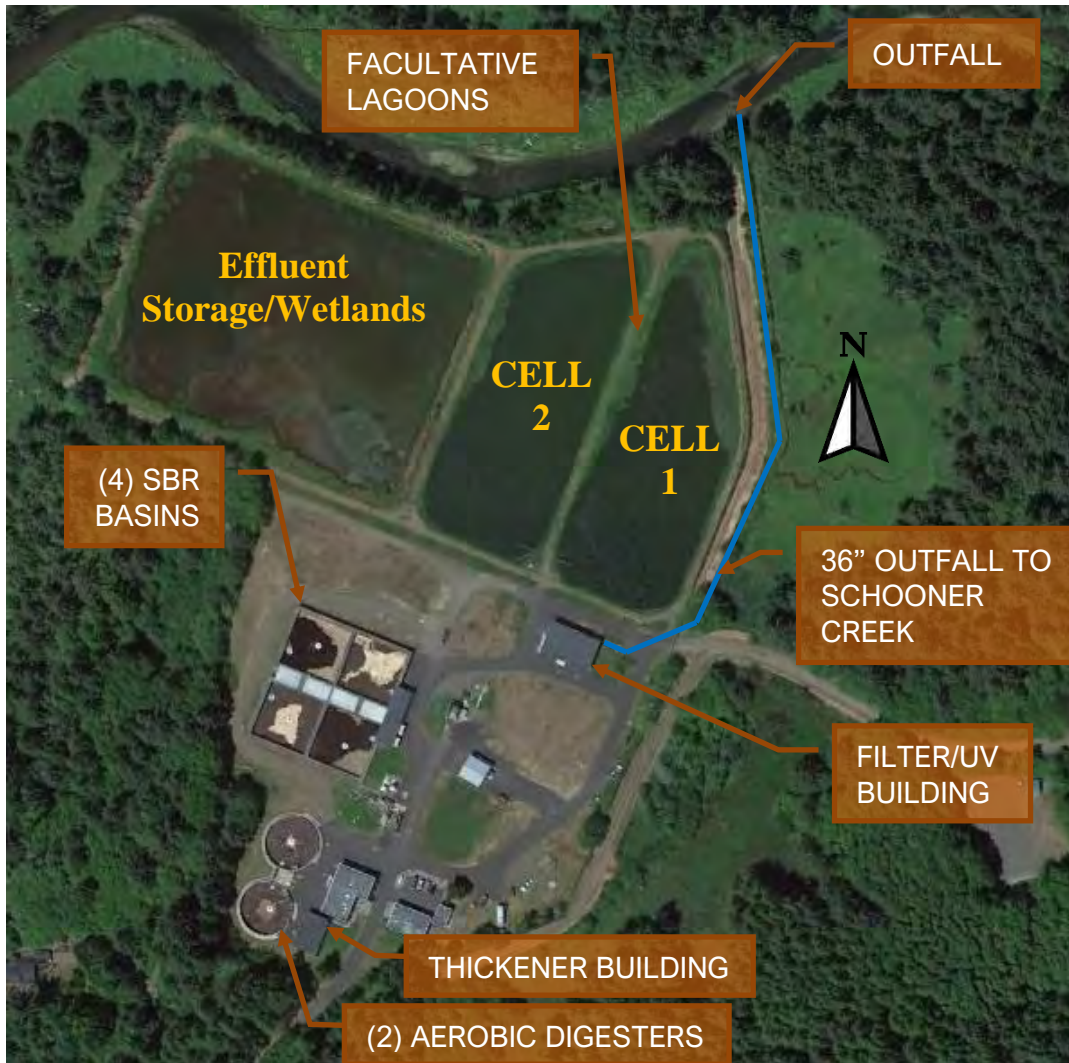


Figure 2 – Wastewater Treatment Plant Site

Description of Existing System

History: The treatment facility was constructed in 1982. In 2011 the City underwent renovations to the existing facility to convert the existing aeration basins to four sequencing batch reactors (SBRs) and the addition of two new cloth-media filters. Solids are sent to the digestors and lagoons for holding before removal and disposal. The updated NPDES permit details interim and final limits for excess thermal load as well as maximum limits for total recoverable copper and zinc.

Permit Limits: As described in Table 1 of this report, the current effluent permit limits for the wastewater facility are as follows:

1. Interim Excess Thermal Load Limit = 31 million kcal/day as a 7-day rolling average
2. Final Excess Thermal Load Limit = 10.7 million kcal/day as a 7-day rolling average

- 3. Total Recoverable Copper Limit = 1.8 µg/L
- 4. Total Recoverable Zinc Limit = 37.1 µg/L

Current Excess Thermal Load, Copper, & Zinc Levels

The City has been tracking daily excess thermal load (ETL) between 2015 and October 2020. Figure 3 plots the seven-day rolling average of excess thermal load over this period in relation to the interim and final limits. The values shown in Figure 3 are in units of million kcal/day. Total copper and zinc have been tracked intermittently beginning in 2017 and through 2020. With limited available data, it is difficult to make categorical statements of the wastewater effluent being discharged into Schooner Creek; however, it seems evident that the discharge greatly exceeds the permitted limits. Table 6 details recorded total recoverable copper and zinc.

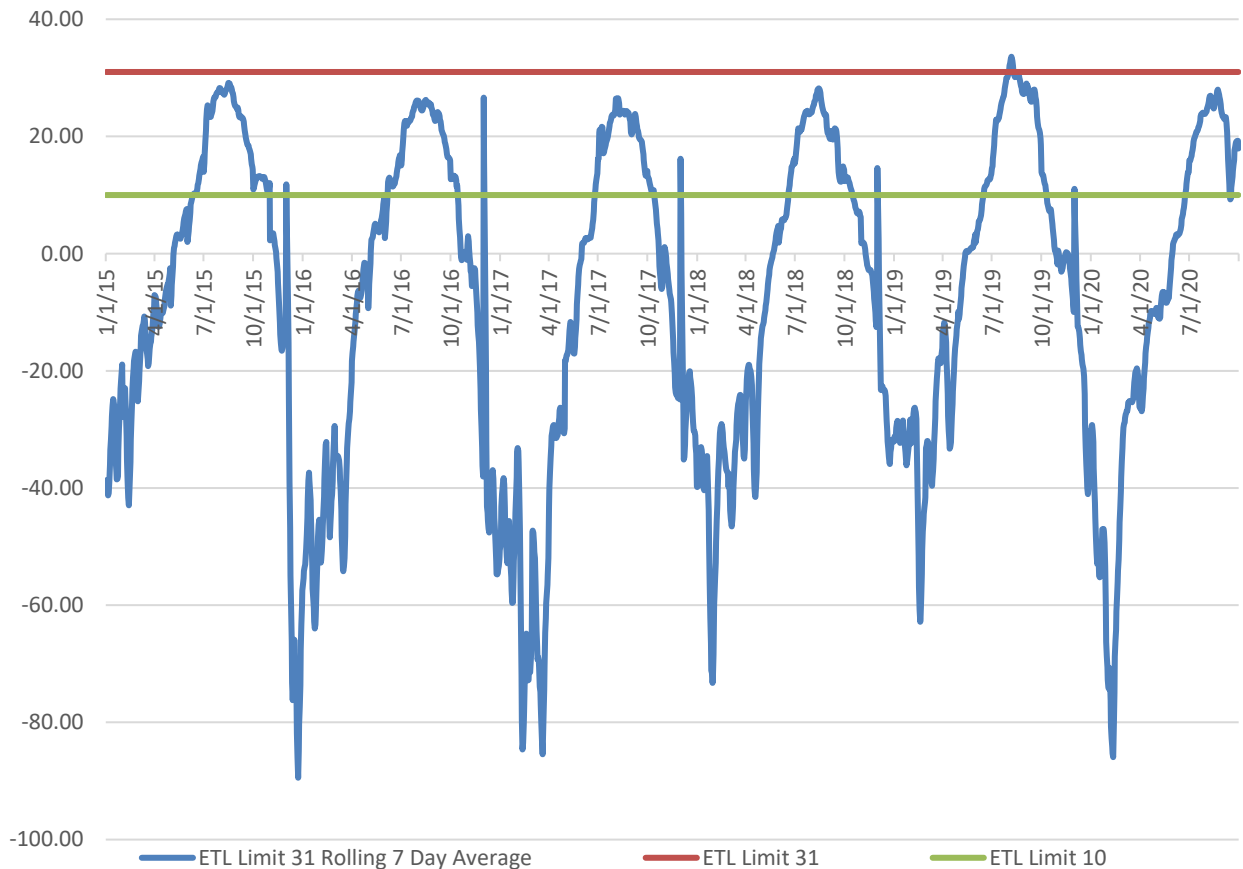


Figure 3 – Seven Day Rolling Average (January 2015 - October 2020)

Table 6 – Monthly Total Recoverable Copper & Zinc

Month	Total Copper (µg/L)	Dissolved Copper (µg/L)	Total Zinc (µg/L)	Dissolved Zinc (µg/L)
July-17	3.6	2.7	No Data	No Data
September-17	2.9	2.1	No Data	No Data
October-17	3	3.4	No Data	No Data
November-17	4.8	3.6	No Data	No Data
December-17	4.3	3.8	No Data	No Data
January-18	4.5	3	No Data	No Data
February-18	2.1	Non-Detect	42.9	42.2
March-18	2.6	2.5	50.1	49.4
April-18	3	3.1	43	40.8
May-18	5	4.1	59.3	59.7
June-18	No Data	No Data	No Data	No Data
July-18	4.9	3	66.4	65.8
August-18	3.5	3.4	64.5	63.7
September-18	6.3	5.2	76	76.5
October-18	6.1	5.2	74.9	73.9
November-18	2.5	2.6	67	68.3
December-18	6.8	ND	69.9	73.7
January-19	2.8	2.4	47.9	48.7
February-19	4.2	2.5	47.4	46.1
March-19	No Data	No Data	No Data	No Data
April-19	No Data	No Data	No Data	No Data
May-20	9.7	4.6	No Data	No Data
June-20	3.9	3.1	No Data	No Data
July-20	3.7	2.8	No Data	No Data
August-20*	2.5	1.9	38	No Data
September-20*	3.3	2.2	63	No Data
October-20*	2.8	2.2	61	No Data
November-20	4.6	2.7	49	No Data
December-20	3.4	2.1	36	No Data

* For August, September, and October of 2020, two samples for Total Copper were recorded. Both samples exceeded the permitted limit, though the sample recorded in Table 6 is the higher of the two samples.

Table 6 shows the available total recoverable copper and zinc data between 2017 and 2020 as recorded by the City.

The City rarely exceeds the interim excess thermal load limit. However, once the final limit becomes the new standard, the City will regularly be out of compliance between June and October. Over the study period the average yearly maximum excess thermal load was 28.7 million kcal/day as a seven-day rolling average and the single yearly maximum recorded excess thermal load was 33.61 million kcal/day. Using this data, for the final permit limits to be met, the average yearly maximum excess thermal load will need to be reduced by 18 million kcal/day and will need to have a single yearly maximum reduction of at least 22.91 million kcal/day.

Evaluation of Alternatives

Without a more detailed study of the City’s wastewater users, as well as individual components of the WWTP, it is challenging to diagnose the largest thermal contributors. It is expected that one of the primary causes of future noncompliance will be discharge flow characteristics. It is believed during summer months the discharge from the WWTP outfall makes up a large percentage of the flow in Schooner Creek due to low summer creek flows. Under this scenario, wastewater discharge would have an outsized impact on stream temperature, making regulatory compliance difficult.

Various methods were analyzed to determine impacts on cooling, as well as the reduction of total recoverable copper and zinc, and their effectiveness in meeting permit requirements.

Methods to Reduce Thermal Loading

The methods described herein provide cooling of the wastewater and would not contribute to the reduction of copper and zinc removal. The methods below would need to be paired with technology for copper and zinc removal listed in the following section of this study.

Influent Cooling

Often times, when municipalities have a large number of industrial users; these users can have an outsized impact on influent temperatures at the wastewater treatment plant. Without cooling measures in place at the WWTP, the influent temperatures are only likely to increase during treatment. Implementing cooling technology at the wastewater plant can be a costly capital project. Implementing this technology will be a cost burden to the overall community. Often times, it is more appropriate to require large industrial users to provide onsite cooling prior to discharge into the public collection system.

To our knowledge, there are limited industrial users within the City, with the majority of the influent being contributed by residential and commercial users. Under these circumstances, influent cooling is unlikely to have much impact on the discharge temperature at the WWTP outfall.

SBR Covers

Solar input can be a large contributor to temperature increase at wastewater plants. Typically, this happens through extended detention times in primary and secondary clarifiers. Aluminum covers can be installed to prevent the introduction of solar input. With the upgrades to the WWTP starting in 2011, the City currently utilizes four SBRs in parallel that are not covered and exposed to sunlight. Each of these reactors are subject to solar input and thus would see a temperature reduction from covering the SBR basins. In order to determine the extents of temperature reduction, temperature gauges would need to be installed throughout the treatment process to determine where thermal contributions are the greatest and how they are influenced by external temperatures and weather patterns.

Costs to install aluminum covers are anticipated to be in excess of \$200,000 per SBR for a total estimated cost of approximately \$800,000. Given the disproportionate discharge of effluent into Schooner Creek during summer months, it is not anticipated that adding covers would bring the City’s excess thermal loading into permit compliance and additional cooling measures would be necessary.



Figure 4 – Example of Aluminum Cover

Summer Storage

Another method of cooling would be to store summer wastewater effluent. Holding the wastewater over the summer for discharge in the fall and winter would allow more time for the stored water to equalize with the ambient air temperature. Between 2015 and 2020, the City recorded an average discharge volume of 185 million gallons per year that exceeded the future final permit limit for daily excess thermal loading. This would mean in order to accommodate the average discharge volume; the City would need approximately 1,650,000 square feet of lagoon space at a 15 ft average depth. Additional storage would need to be considered for peak flows and precipitation, which are not included in this estimate. The cost to construct the lagoon is estimated to be in excess of \$4,000,000, with additional cost for piping, appurtenances, land acquisition, supplemental storage for design and precipitation.

Mechanical Cooling

Direct cooling options include utilizing chillers, heat exchangers, and cooling towers to reduce the temperature of wastewater effluent. A mechanical cooling system would be installed between the SBRs and the cloth-media disk filtration system. In principle, effluent from the SBRs is delivered to two heat exchangers. The waste passes through the heat exchanger which is filled with chilled water. The process of passing the warmer wastewater through the chilled water will cool the waste based on designed input conditions.

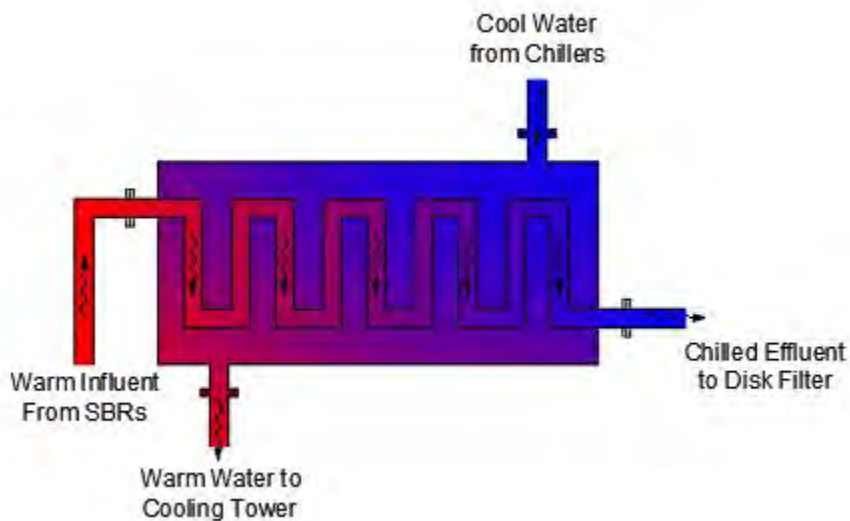


Figure 5 – Sample Heat Exchange Process

Cooled water from the chillers fills the interior of the heat exchanger. As the warm influent from the SBR passes through this chilled water, the temperatures inside the exchanger begin to equalize. This process causes a temperature reduction in the wastewater and an increase in cool water delivered from the chiller. After passing through the heat exchangers, the chilled wastewater effluent would be sent on to the City’s cloth-media disk filters before the filtered effluent is disinfected and discharged into Schooner Creek. The warmed water from the chiller is delivered back to the chillers and pumped to the cooling towers. The warmed water discharges in the top of the cooling tower and percolates through the tower. The hot saturated air then evaporates out the top of the tower. A diagram of the Aerefc cooling tower is shown in Figure 6 below.

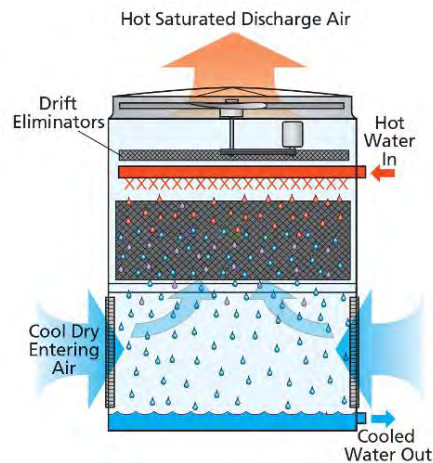


Figure 6 – Cooling Tower Diagram

Cooled air is delivered back to the chillers where it is once again pumped back into the heat exchangers, completing the closed loop system. Figure 7 shows a schematic of the Aerefco system that was used to generate an estimate for the mechanical cooling system.

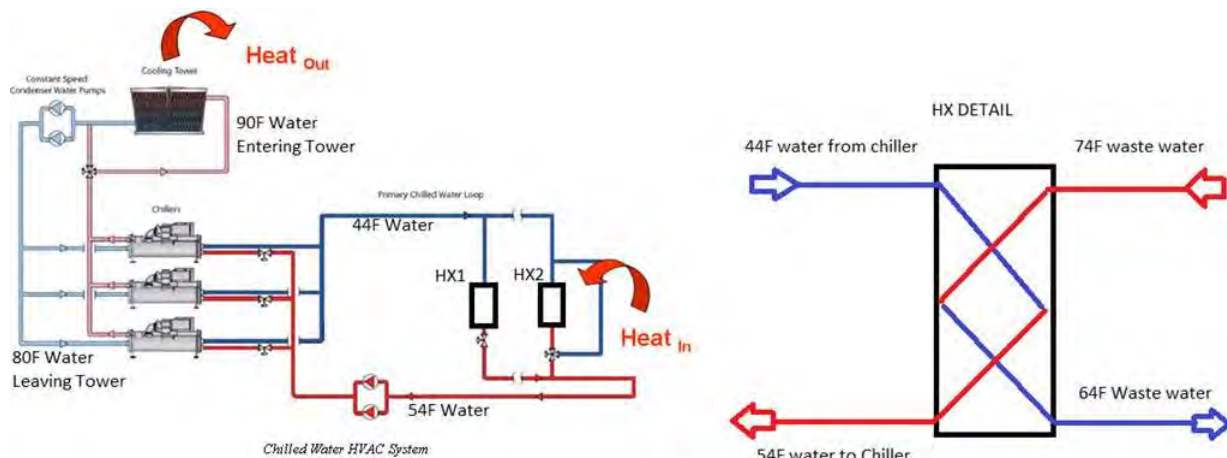


Figure 7 – Aerefco Direct Cooling System Schematic

Using the maximum historic excess thermal loads and design flow from the study period, it is estimated that Lincoln City would need roughly 1,350-ton chillers. Three 675-ton chillers would be needed to provide redundancy to the system along with two Alfa Laval Stainless Steel heat exchangers and three Evapco Stainless Steel Cooling towers for the system. The total material costs are estimated at approximately \$900,000, with an additional \$2,000,000 for installation, and approximately \$1,000,000 in piping, equipment, and facilities costs. Land acquisition and operating costs are not included in this estimate. When speaking with Aerefco, they noted it would be impossible to estimate operating costs without a more complete design of the system. Traditionally, operating costs for direct cooling systems are typically cost prohibitive. Aerefco noted an electrical design engineer would typically estimate the operating power requirements for the system.

Methods to Reduce Total Recoverable Copper & Zinc

Additional Filtration

Cloth-Media Disk Filters can be used for the reduction in particulate effluent copper and zinc. The City is currently utilizing OptiFiber PES-13® cloth filtration media with a nominal rating of 10 microns. In speaking with Aqua-

Aerobics, the City could look into upgrading the current cloth-media to OptiFiberPES-14 cloth filtration media, which has a nominal rating of 5 microns. Aqua-Aerobics anticipates this would have a marginal impact on reducing copper and zinc levels in the effluent and would not on its own meet the new permit limits.

Membrane or sand filtration can alternatively be used for filtration of heavy metals in fluids. However, similar to cloth-media disk filters, they will primarily remove particulate metals. In reviewing copper and zinc sampling data as shown in Table 6 above, the majority of the City’s copper and zinc issues appear to not be in particulate form, but are dissolved, thus it would be unlikely to be filtered out by membrane or sand filtration.

Ion Exchange

Since the majority of the copper and zinc in the City’s is dissolved, to remove them from the effluent, it will first require bringing them out of solution. One method of achieving this is through ion exchange. Simply put, ion exchange is removing one ion from the solution and replacing it with another. In a wastewater application, the influent passes through a resin column and the target metals attach themselves to the resin in exchange for a similarly charged ion.

According to the EPA Summary Report for the Control and Treatment Technology for the Metal Finishing Industry included in Attachment 3, the City can expect to budget approximately 2 gpm per cubic foot of resin. At a design capacity of 11 MGD, the City can expect to need approximately 3,800 CF of resin column. Industry budgetary estimates figure \$1,000-2,000 per cubic foot of resin column. This provides a high-level planning estimate of \$3,800,000-\$7,600,000 for an ion exchange system.

Chemical Precipitation

Chemical precipitation involves the addition of coagulant to the wastewater in an attempt to precipitate heavy metals out of solution. Evoqua typically recommends the CoMag system to boost the performance of chemical flocculation. Floc removed from the systems would be delivered to solids handling at the existing wastewater plant. Evoqua used design flows of 11 MGD peak instantaneous flow (PIF) and 7 MGD average daily flow (ADF) to size a potential CoMag system. The system would use two to four flocculation tanks followed by one clarifier. A second clarifier could be utilized for redundancy. For a system of this size, Evoqua estimated a budgetary capital equipment cost on the order of \$1.5-2.5 million. Installation of the equipment, tanks, and buildings would be approximately another \$2-3 million, not including any potential land acquisition costs.

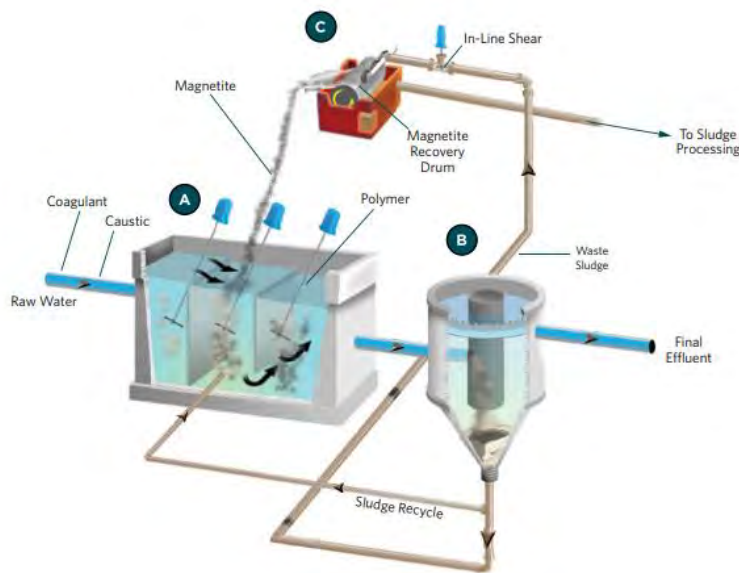


Figure 8 – Evoqua CoMag System Overview

It should also be noted that the CoMag system typically produces removal rates of 15% for zinc and 25% removal for copper. With the current levels sampled, the City would need to have removal rates between 30-50% for zinc and 50-80% for copper. Prior to the investment in any chemical precipitation system, further jar testing and pilot studies would be required.

Combined Methods of Compliance

Ocean Outfall

Alternative to making significant modifications to the WWTP would be the relocation of the City's outfall. One of the primary reasons for noncompliance with permitted excess thermal load, copper, and zinc limits is the low flow in Schooner Creek during summer months. This causes the City's discharge to have an outsized impact on stream characteristics. Creek flows during summer months are expected to continue declining in the future. One way to avoid these impacts is relocate the City's outfall location to an area where the effluent will not have a disproportionate impact. An ocean outfall would increase the volume of receiving waters and thus decrease the impacts of the warmer discharge. DEQ has permitted a number of ocean outfalls along the Oregon Coast and stated it would be a possibility for the City of Lincoln City to construct one as well.

Three different route alternatives were proposed as potential transmission mains: S Schooner Cr Rd, SE 51st St, and SE 54th Dr. Figures showing these potential alignments are included in Attachment 4. Table 7 below breaks down the characteristics of each option.

Table 7 – Ocean Outfall Transmission Main Route Options

Transmission Route Name	Length	Number of Pump Stations	Planning Level Cost
S Schooner Cr Rd	10,900 LF	2	\$7,000,000 – \$9,000,000
SE 51 st St	9,150 LF	1	\$6,500,000 – \$8,500,000
SE 54 th Dr	9,150 LF	1	\$9,000,000 – \$11,000,000

The ocean outfall would likely be a 12" HDPE pipe bored just above the tertiary marine sedimentary bedrock layer in the Pacific Ocean. A geotechnical report would be needed to determine the depth of the bore. It is anticipated this would be approximately 40-60 ft below sea level. Approximately 1,500-2,000 ft west of the ocean surf break, a 10" vertical riser would extend above the ocean floor with diffuser checks at the point of effluent discharge.

While the initial capital costs of the ocean outfall is high, the ongoing operational costs are limited to maintenance of the outfall and pump station(s). Over time, sediment may build up around the discharge point and can bury the diffuser checks, making it necessary for periodic extensions to the vertical riser pipe.

In addition to the low maintenance costs, ocean outfalls address both excess thermal load and heavy metal issues and would eliminate the need to pair multiple technologies to address compliance issues. Most future effluent permit limit revisions/restrictions will most likely also be addressed by the ocean outfall. Permit costs to complete this work would likely be higher than all other options, except potentially bank shading. The figures included in Table 7 include construction, contingency, engineering, as well as legal and admin costs.

Mixing Oceanwater or Groundwater

An alternative to relocating the effluent outfall is to supplement the wastewater effluent with water. The three main sources to supplement mixture of the effluent are domestic water, groundwater, or oceanwater. To determine the amount of mixing water necessary to meet the new permit limits, excess thermal load as well as copper and zinc must be analyzed separately.

Mixing for Excess Thermal Load

Daily excess thermal load data provided by the City was analyzed to determine the amount of water necessary to be added to bring the combined excess thermal loading below the final permit limit of 10.7 million kcal/day as a seven-day rolling average. To meet permit requirements, it is necessary to supplement daily discharge during the summer and early fall months, particularly from June through October.

Between 2015 and 2020, when daily thermal load data was provided by the City, it was found the City would need to add approximately an additional 0.5 MGD on average at an average groundwater temperature of 12.2°C to reduce the daily excess thermal load into compliance with the final permit limit. The maximum daily addition noted was 1.75 million gallons. Since this maximum daily addition is based on only five years of data, the system should be designed to account for a minimum of 2.5 MGD.

Mixing for Copper and Zinc

It is necessary to design for the worst-case scenario in addressing copper and zinc. The average monthly copper levels recorded by the City was 4.3 µg/L and 56.3 µg/L for Zinc. This would require a 58% reduction in copper and a 34% reduction in zinc levels. The maximum recorded copper sample during the two-year sample period provided by the City was 9.7 µg/L, while the maximum recorded zinc sample during the same period was 37.1 µg/L. Given this data, the City should be prepared to provide for at a minimum 82% reduction in copper levels and a 52% reduction in zinc levels. Between 2015-2020, the City recorded an average daily effluent flow of 2.05 MGD from the wastewater plant.

To provide the necessary reduction in copper levels to meet the new permit limits, the City would need to be prepared to supply an additional 9 MGD or an additional 13.93 cfs.

Sourcing Mixing Water

If supplementing daily wastewater flows utilizing domestic water, the City would need to supply an additional design flow of 13.93 cfs (9 MGD) in domestic water to their daily wastewater flows. This would add an undue burden to the City's water treatment facilities and distribution system and is not recommended.

Pumping ocean water to the wastewater plant to supplement treated effluent is a possibility. The City would need to permit a new water right to pump water from the ocean, as well as construct a pump station and transmission main to deliver oceanwater to the WWTP. The City would need to construct a 6,300 GPM pump station and mixing basin to mix the flows prior to discharge into Schooner Creek.

The final alternative would be to drill groundwater wells at the treatment plant to supply the supplemental flow to the wastewater effluent. There are no local groundwater wells in the area to determine the viability of utilizing groundwater as a supplemental water source. This is likely due to saltwater influence in the local groundwater. A geotechnical investigation would be necessary to determine the viability of utilizing wells as a supplemental water source.

Concerns with this method surround the limited amount of data recorded by heavy metals. Any source water would need to be analyzed for preexisting copper and zinc, which may further contribute to the City's heavy metals found in the wastewater. A more in-depth study is necessary to determine the relationship of seasonal flows and heavy metals as high copper levels during maximum recorded flows would be likely to greatly increase the amount of mixing water necessary. For example, the maximum recorded daily flow between 2015-2020 was 7 MGD. Should a copper spike of 9.7 µg/L occur during this period of max flow, the amount of mixing water required to bring copper levels into compliance would jump to 24.4 MGD, requiring a 17,000 GPM pump station. Additionally, future permit changes could require more stringent copper and zinc levels requiring the City to continue increasing the amount of mixing required. While mixing may be feasible, there are far too many unknowns that must be addressed through further sampling and a geotechnical report to recommend this option.

The mixing water alternative is not recommended for bringing copper or zinc levels into compliance with the new permit limits.

Alternative Methods of Compliance

Bank Shading/Thermal Credits

OAR 340-041-0028(12)(f) allows for, “thermal water quality trading in whole or in part to offset its temperature discharge, so long as the trade results in at least a net thermal loading decrease in anthropogenic warming of the water body and does not adversely affect a threatened or endangered species.” Recently many agencies are engaging with DEQ in trading credits to offset their impacts to the discharge waters. The agency works closely with DEQ to create models and identify areas along Schooner Creek that would benefit from bank shading. Bank shading reduces the temperature of the stream creating a more ideal habitat for native species to live and offsets the impacts of excess thermal loading at the wastewater plant’s point of discharge. Additionally, the planting of trees removes pollutants from the air and in general creates a more appealing environment for the public.

In order for DEQ to approve bank shading or other methods of trading thermal credits, the City would need to show that any alternative method of compliance puts undue hardship on the City. While this is the ultimate goal of the study, it is not known at this time if DEQ will accept the use of thermal credits, nor to what extent work would be required. For these reasons, it is not possible to provide a cost estimate to proceed with this method of compliance. However, it should be noted that trading thermal credits only serves to bring the City into compliance with the final excess thermal load limit. The City would still need to make improvements to their treatment plant to address compliance issues surrounding total recoverable copper and zinc described above.

Conclusions

The source of the problem faced by the City is mixing large wastewater effluent flows with limited flows in Schooner Creek during the summer months. The small mixing zone creates compliance issues for copper and zinc, as well as future compliance issues with meeting the final permit limits for excess thermal load. Due to the limiting physical characteristics of Schooner Creek, this forces any improvements to the City’s wastewater plant to have high capital costs that require large amounts of space. Addressing the thermal loading of the effluent waste and heavy metals individually, would require a complete renovation of the City’s wastewater plant that was recently upgraded in 2011. Costs of improvements at the WWTP are estimated between \$6-10 million with additional costs for land acquisition. Additionally, improvements at the wastewater plant will have high recurring operating and maintenance costs.

The only feasible means of cooling discussed in this study is a direct cooling system or a new storage lagoon for summer storing. The estimated costs for the storage lagoon is approximately \$4,000,000 just to construct the lagoon and would not include costs for land acquisition, piping, and pumping. The primary reason for not including costs for these items is due to the uncertainty in land available and if the lagoon would be able to be constructed on site or if wastewater would need to be pumped off site for summer storage. Costs for direct cooling are estimated at approximately \$4,000,000 for equipment purchase and install. Additional costs may be needed for land acquisition with additional high operating and maintenance costs for this facility, which vary widely due to numerous variables.

The primary means of copper and zinc reduction would be chemical precipitation. When speaking with Evoqua about a chemical precipitation system, they recommended the CoMag system. Estimated costs for the CoMag system are \$3.5-\$5.5 million with potential additional costs for piping, pumping, and land acquisition. However, Evoqua stated the traditional removal of copper and zinc using the CoMag system would likely not be sufficient to bring the City back into DEQ compliance. Evoqua stated further jar testing and studies would be required.

Due to the unlikely feasibility of heavy metal (copper and zinc) removal using chemical precipitation, we cannot recommend the use of any technologies that separately address temperature and heavy metals. It is

recommended to utilize a combined approach to address both compliance issues (temperature & heavy metals) at the same time.

The recommended alternative is to focus on the ocean outfall approach. While this approach has a high initial capital costs, ongoing operation and maintenance costs are limited, compared to all other alternatives. Additionally, the relocation of the City's wastewater outfall to the Pacific Ocean means the City is unlikely to be subject to further WWTP modifications brought about by future changes to the City's NPDES permit. Additionally, the ocean outfall is a known option to address both temperature and heavy metals issues without needing further studies to locate sufficient groundwater for mixing or the need to secure additional water rights.

While mixing is recognized as a possible solution to both temperature and heavy metals, there are a large number of unknowns associated with this solution. The degree of unknowns surrounding water source availability and heavy metal data makes it impossible to accurately estimate capital or operating and maintenance costs associated with this option. For this reason, the mixing of groundwater or oceanwater cannot be the recommended option as part of this feasibility study. However, should the City seek alternatives to the ocean outfall, the mixing of groundwater is recognized as the primary alternative to the ocean outfall, pending further studies. Beyond mixing, the next best alternative is direct cooling pending further jar tests to determine the viability of chemical precipitation.

Recommended Actions

We recommend the City move forward with relocating the current outfall to the Pacific Ocean. Therefore, the City should begin the permitting process for this work immediately and begin working with a geotechnical and civil engineer to determine the most reasonable alignment for the transmission main.

An ocean outfall will require extensive permitting that is likely to take years. It is recommended the City begin moving forward with a facilities plan, followed by permitting and preliminary design. Each of the three options for the ocean outfall will require new easements and potential land acquisition. The following steps are necessary to meet the compliance schedule listed in table 5 above and in Schedule C of the NPDES permit.

1. Submit yearly written progress reports outlining the progress made towards achieving the final effluent limitations.
2. December 31, 2028 – Complete a Facilities Plan that selects options for improvements to bring the City within compliance of the NPDES permit. The City should immediately begin securing funding for the recommended design and proceed with permitting and preliminary design.
3. December 31, 2031 – Evaluate and obtain financing for improvements to wastewater facilities recommended in Facilities Plan.
4. December 31, 2032 – Complete Preliminary Design Report and submit to DEQ for review and approval.
5. December 31, 2033 – Complete Final Design and submit to DEQ for review and approval.
6. October 31, 2037 – Complete construction of wastewater facility improvements to comply with the copper, zinc, and excess thermal load final effluent limits.
7. December 1, 2037 – The City must have achieved full compliance with the final permit limits and provide written notification of compliance to DEQ.

The City should immediately look to secure funding to complete further studies and facilities plan to further lay out options described in this feasibility study. The City should proceed with the facilities plan as soon as possible in order to meet the scheduled dates detailed above in this section.

Lincoln City Wastewater Feasibility Study
October 8, 2021
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If you have any questions or concerns regarding this evaluation, please feel free to contact us at mdelmoro@hbh-consulting.com or achernishov@hbh-consulting.com or 503-554-9553.

Sincerely,
HBH Consulting Engineers, Inc.

Matthew Del Moro, PE
Project Engineer

Andrey Chernishov, PE
Principal Engineer

Attachments:

Attachment 1 – 2016 Mixing Zone Study

Attachment 2 – City of Lincoln City - DEQ NPDES Permit #101122

*Attachment 3 – EPA Summary Report: Control and Treatment Technology
for the Metal Finishing Industry: Ion Exchange*

Attachment 4 – Ocean Outfall Transmission Main Route Options

Attachment 1
2016 Mixing Zone Study

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503-423-4000
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Level 2 Mixing Study City of Lincoln City WWTP Discharge to Schooner Creek

29 December 2016

Prepared for
City of Lincoln City
P.O. Box 50
801 SW Highway 101
Lincoln City, Oregon 97367

K/J Project No. 1676017.00

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- C CORMIX Session and Prediction Files Output (also on CD in Appendix B)

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List of Acronyms

%	Percent
CFS	Cubic feet per second
City	City of Lincoln City, Oregon
Deg	degree
DEQ	Department of Environmental Quality
DF	Dilution factor
DMR	Discharge Monitoring Reports
DWDF	Dry Weather Design Flow
ESU	Evolutionary Significant Unit
ft	Feet
ft/s	Feet per second
IMD	Internal Management Directive
Kennedy/Jenks	Kennedy/Jenks Consultants
m/s	Meters per second
MGD	Million gallons per day
MHW	Mean High water
MLLW	Mean Low Low Water
MLW	Mean Low Water
mph	Miles per hour
mS/cm	MilliSiemens per centimeter
MZ	Mixing zone
NA	Not applicable
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rule
°C	Celsius
°F	Degrees Fahrenheit
ORBIC	Oregon Biodiversity Information Center
ppt	Parts per thousand
SC	Species of Concern
SV	Sensitive and Vulnerable
Te	Effluent Temperature
WWTP	Wastewater treatment plant

Executive Summary

This report provides the results of a Level 2 mixing zone study for the discharge of treated effluent from the City Lincoln City wastewater treatment plant (WWTP) to Schooner Creek. The mixing study was conducted as a condition for renewal of the City's National Pollutant Discharge Elimination System (NPDES) discharge permits. The WWTP outfall is located at approximate river mile (RM) 1.1 of Schooner Creek, on the south end of Lincoln City, Oregon.

The Level 2 Mixing Study includes the requirement for environmental mapping of sensitive receptors (e.g., fish spawning habitat, drinking water withdrawal, or recreational swimming areas) in the vicinity of the discharge. The environmental mapping effort consisted of looking for water intakes, recreational uses, and protected species habitats; and did not find sensitive receptors or habitats that are likely to be affected in the mixing zone discharge area. Level 2 Mixing do not require a dye study; however, Kennedy/Jenks did collect conductivity and temperature data to support model verification.

Critical conditions for the mixing study occur when flow in Schooner Creek is lowest, typically near the end of summer/early fall. Schooner Creek in the vicinity of the outfall is also tidally influenced as a result of proximity to the Pacific Ocean. Kennedy/Jenks Consultants (Kennedy/Jenks) used a flow meter to measure receiving water current velocity, depth, and temperature over a one month period from September through October to capture a full tidal (lunar) cycle of tidal influence while the river is at the presumed low flow stage. These data were used to extrapolate receiving water critical low flow conditions. Record drawings and field measurements for the outfall and creek bed were used to generate outfall geometry used in the modeling.

The discharge and receiving water data were used as inputs to the CORMIX mixing zone model which was used to estimated dilutions at the edge of the regulatory mixing zone for chronic and human health conditions. The CORMIX model was unable to fully predict plume characteristics for acute conditions because of the high effluent flow rate and low river velocity. Kennedy/Jenks made some adjustments to the model parameters and used dilution values closer than the regulatory mixing zones to make reasonable estimates of the dilutions.

The dilution factors in Table ES-1 below are based on this modeling and were used to evaluate discharge conditions in the receiving water.

Details of the environmental mapping and mixing study inputs, results, and sensitivity analysis are presented in this report.

Table ES-1 - Summary of Recommended Dilution Factors

Condition	Distance from Outfall	Dilution Factor (centerline)
Acute	20 foot radius	1.04*
Chronic	20 foot from bank and 200 feet up and downstream of the discharge	3.5**
Human Health	20 foot from bank and 200 feet up and downstream of the discharge	3.2**

Notes:

* Based on temperature measurements

** Dilution where plume centerline crosses 20 foot width of regulatory mixing zone

Section 1: Introduction

The City of Lincoln City, Oregon (City) discharges highly treated effluent to Schooner Creek via an outfall located near River Mile 1.1, near the south end of Lincoln City (Figure 1). The City discharges under an individual National Pollutant Discharge Elimination System (NPDES) permit (No.101122) issued in October 2003 and subsequently administratively extended. This study was prepared in support of renewal of the current permit and a copy is provided in Appendix A.

The Permit includes a designated mixing zone for the outfall:

“The allowable mixing zone is that portion of Schooner Creek within a band extending out twenty (20) feet from the point of discharge and extending two hundred (200) feet upstream and downstream from the point of discharge. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within twenty (20) feet of the point of discharge.”

The Oregon Department of Environmental Quality (DEQ) has requested that the City updates its previous mixing study to meet the Level 2 requirements described in DEQ’s Regulatory Mixing Zone Internal Management Directive, Part Two, Mixing Zone Studies (DEQ 2013). This report summarizes the data used as inputs to the mixing modeling and the resulting estimates of dilution within the mixing zone. A Level 2 Mixing Study requires the following:

- Environmental Mapping to assess potential impacts of the mixing zone on sensitive species and habitats, and to human related beneficial uses (Section 2).
- Collection of field and engineering record data about the outfall for use in the modeling (Section 3).
- Collection of field data on the ambient receiving water conditions including velocity, temperature and channel geometry for model inputs (Section 4).
- A summary of discharge flow and temperature characteristics for the model (Section 5).
- A report of the modeling results, including an assessment of the model sensitivity to input parameters (Section 6).

Section 2: Environmental Mapping

The Level 2 mixing study includes the requirement to conduct environmental mapping to identify potential sensitive receptors such as drinking water intakes, recreational use, shellfish beds, and fish spawning areas. Kennedy/Jenks Consultants (Kennedy/Jenks) reviewed published data from sources listed below and a biologist, Gregg Bryden, twice visited the area (during low and high tides) to assess habitat conditions. The outfall details and pictures of the vicinity of the outfall are shown on Figure 2.

2.1 Environmental Setting

Schooner Creek drains a relatively small watershed, draining approximately 9,650 acres between Devils Lake tributaries Rock Creek to the north, Salmon River tributary Bear Creek to the northeast, and Drift Creek and its tributaries to the south and east (Cutthroat Consulting 2012). Ownership in the drainage basin is a mix of public and private ownership, consisting mostly of undeveloped forest land with some very low density housing present on private holdings. Schooner Creek flows to the north end of Siletz Bay near the opening of the Bay to the Pacific Ocean. The lower roughly two miles of Schooner Creek, including the area of the discharge, is tidally influenced and estuarine in nature. The banks of the Creek are deeply cut through tidal action and the bottom is generally soft silts and sandy, with nominal aquatic vegetation. While the watershed is small, the drainage is subject to heavy winter storms and strong tidal surge resulting in dynamic shifting bottom substrate and deposition of some large woody debris.

Conductivity measurements, taken in connection with the mixing study, indicate that there is some salt intrusion resulting in a stratified freshwater layer on top of tidal salt water in the vicinity of the outfall during extreme high tides. During September 2016, the water level in the main channel of Schooner Creek varied from about 0.50 feet during low tide to about 4.75 feet during the highest tides. This tidal influence affects the habitat in the area of the discharge and produces poor mixing during low water level conditions. The saltwater stratification does not directly influence the mixing characteristics of the discharge plume.

The area surrounding the Creek in the discharge is generally flat with some trees and open wet meadows. Much of the north side of Schooner Creek in the outfall area is open space with trees and meadow; however, the area on the north side of the mouth of the creek is developed. The south side of Schooner Creek includes the wastewater treatment plant (WWTP) which appears to be built on a former meadow area and a remnant of the meadow is present to the east of the WWTP. The south bank of the river downstream of the discharge is generally steep forested land with a narrow river bank margin. The mouth of the Creek opens into shallow bay flats consisting of sandy silt and sands. Aerial photographs suggest that the River Channel extends into the bay and connects with the mouth of the Bay about 3,000 feet directly to the west.

The Designated Beneficial Uses of the Mid Coast Basin ([Oregon Administrative Rule] OAR 340-41-0220, Table 220A), for estuaries and marine waters, including the lower reach of Schooner Creek are as follows:

- Industrial Water Supply
- Fish & Aquatic Life
- Wildlife & Hunting
- Fishing
- Boating
- Water Contact
- Recreation
- Aesthetic Quality, and
- Commercial Navigation & Transportation

2.2 Habitat and Special Status Species

According to DEQ's Division 41 Fish Use Designations Maps 220A and 340B, Schooner Creek is designated for salmon and trout rearing and migration; but the lower reach, including the area of the discharge, is *not* designated for salmon and steelhead spawning. This designation is consistent with the observed lack of appropriate spawning substrate (is mostly fine silts and sands and no apparent gravel beds) and the measured brackish water quality that is likely too saline at times, even for chum salmon spawning. Upper reaches of Schooner Creek do host salmonid spawning from 15 October through 15 May.

Kennedy/Jenks requested a database search for rare, threatened, and endangered plants and animals from the Oregon Biodiversity Information Center (ORBIC) for the outfall vicinity. The following protected fish species are potentially present in Schooner Creek:

- Pacific lamprey (*Entosphenus tridentatus*), a federal Species of Concern (SOC), and state Sensitive and Vulnerable (SV)
- Chum salmon (*Oncorhynchus keta* pop. 4, Pacific Coast Evolutionary Significant Unit [ESU]), state Species of Concern (SC)
- Coho salmon (*Oncorhynchus kisutch*, pop. 3, Oregon Coast ESU)
- Steelhead (*Oncorhynchus mykiss*, pop. 30, Oregon Coast ESU, summer run), a federal SOC and state SV
- Steelhead (*Oncorhynchus mykiss*, pop. 31, Oregon Coast ESU, winter run), a federal SOC and state SV
- Chinook salmon (*Oncorhynchus tshawytscha*, pop. 27, Oregon Coast ESU, spring run), a state SC.

The ORBIC database also indicated that the American bald eagle (*Haliaeetus leucocephalus*) has breeding sites within the Schooner Creek watershed; however, no bald eagle nesting or foraging activity was observed in the area during the site visits. The ORBIC database is not included with this report because of confidentiality requirements for release of this sensitive data. A copy of the ORBIC report is held in the Kennedy/Jenks project file.

The river is likely habitat to numerous species of invertebrates, reptiles, and amphibians, is used by aquatic mammals (otter, beaver, nutria, etc.) and resident and migratory birds.

2.3 Recreational Use

A public park is located at the mouth of the river about one mile downstream of the outfall. This park provides beach access to the public that includes direct contact, boating, fishing and shellfish harvesting.

This reach of the river is used for fishing and kayaking, although access is limited. While freshwater clams and mussels may be present, their distribution and limited access makes it unlikely that significant shellfish harvesting occurs in the area.

2.4 Water Uses

Kennedy/Jenks reviewed Water Resource Department records for water rights and points of diversion (withdrawals) in the vicinity of the outfall (Figure 3). While there are some nearby uses of water for domestic, irrigation, livestock, and recreational uses, none of these is sourced from diversions from Schooner Creek. There is no known point of diversion for water within one mile of the discharge.

2.5 Conclusion

There does not appear to be any sensitive receptors in the immediate vicinity of the outfall that would be affected by the designated mixing zone. Special status fish species do pass through the area of the discharge however, the exposure time is minimal and likely reduced through avoidance behavior. Schooner Creek flows to an estuary that has many beneficial uses; however, these beneficial uses should be protected if water quality standards are met at the edges of the mixing zone.

Section 3: Outfall Location and Geometry

The outfall is located on the left bank of the Schooner Creek near River mile 1.1 (Figure 1). The WWTP outfall geometry was gathered from record drawings of its construction by Straam Engineering, Inc. dated April 1979 and Kennedy/Jenks field visit on 30 August 2016. Outfall details and the relative location are shown in Figure 2.

3.1 Outfall Geometry

The outfall geometry is based on the record drawing of the outfall shown on Figure 2. The following parameters were used in the CORMIX 3 model.

Table 3.1 - Outfall Geometry

Parameter	CORMIX Variable	Value	Unit
Nearest Bank	NB	Left	Left/Right
Port Diameter	D0	3	ft
Port Cross-sectional Area	A0	7.06	ft ²
Depth at discharge	HD	1.25 ^a	ft
Average depth	HA	1.53 ^a	ft
Vertical angle of discharge	THETA	0	deg
Horizontal angle of discharge	SIGMA	90	deg

Notes/Abbreviations:

(a) The depth of the outfall port and its distance from the bank varies depending on river stage. The appropriate dimensions were determined following the depth/flow study discussed in Section 3 below.

deg = degree

ft = feet

ft² = square feet

Section 4: Ambient Receiving Water Conditions

The vicinity of the discharge is within a tidally influenced transition area where flow from a relatively small (approximately 11,500 square mile) watershed drains from freshwater stream to an estuary within Siletz Bay. There is no known permanent gauging station on Schooner Creek to provide historical flow data to estimate average low flow 10 year return period data. Therefore, Kennedy/Jenks collected ambient velocity, stage, and temperature data during the anticipated critical condition period (late summer to fall transition before the winter wet season begins) in 2017. The data collection period was timed to cover two extreme low tide events.

Ambient receiving water conditions were estimated by measuring river velocity, depth, and temperature in the area of the outfall (about 50 feet downstream and 30 feet off the bank) using a STARFLOW ultrasonic flow meter. The meter was deployed for a period of 30 days from 30 August through 29 September 2014. The meter recorded data every 15 minutes and the raw data is provided in Appendix B.

4.1 River Velocity and Stage

Using the measured stream velocity and depth data from the study, Kennedy/Jenks developed a stage height to flow relationship. We also estimated the stream velocity during critical conditions as defined in the internal management directive (IMD) for tidally influenced water bodies as described in Table 4.1.

Table 4.1 – Estimated Receiving Velocity and Depth at Critical Conditions

Water Quality Criteria	Ambient Velocity for Marine/Estuarine Waters	Ambient Diffuser Depth
Aquatic Life, Acute	10 th and 90 th percentiles over tidal cycle = 0.14 ft/s and 0.617 ft/s	Measured depth at MLLW = 0.60 ft
Aquatic Life, Chronic	50 th Percentile velocity over one tidal cycle = 0.33 ft/s	Depth at MLLW = 0.60 ft
Aquatic Life, Human Health	50 th Percentile velocity over one tidal cycle = 0.38 ft/s	Depth at MLLW = 0.60 ft

Notes/Abbreviations:

ft/s = feet per second

MLLW = Mean Low Low Water

The Critical density profile under acute and chronic conditions is the profile that produces the lowest mixing. For Human Health, the critical profile is that which produces average mixing. See discussion of the non-effect of stratification in Section 6 below.

4.2 Receiving Water Temperature

The STARFLOW meter recorded receiving water temperature during the flow study and reported a minimum temperature of 51.8 degrees Fahrenheit (°F) and an average temperature of 59.8 °F. These data indicate a fairly wide range of temperatures during the discharge period,

including the early fall season low flow conditions. As a result, we modeled each critical condition at 51.8 and 60.6 to assess the sensitivity of the model to receiving temperature effects on plume buoyancy.

4.3 Tidal Influence

Schooner Creek is influenced by tidal cycles due to its discharge location within Siletz Bay. The tidal influence produces two tidal cycles within the creek, a common occurrence on the west coast. The average tidal cycle between the Mean Low water (MLW) and Mean High water (MHW) is six (6) hours.

During high tides, the overall stream velocity slows considerably, but no change was observed in the velocity data collected by the STARFLOW meter. This condition is favorable as the effluent is never pushed upstream of the outfall. Even at the absolute minimum velocity, the drifting organism would travel 20 feet within 4.6 minutes, which reduces the immediate exposure aquatic life would experience within the creek.

4.4 Stratification

Kennedy/Jenks observed no indication of salt water intrusion (i.e., high conductivity measurements indicative of salt water) during low tide conditions on 30 August 2016. However, salt water intrusion and stratification was observed during high tide conditions on 20 September 2016. At this time, the conductivity (a field measure of salinity) near the bottom of the channel was 38.6 milliSiemens per centimeter (mS/cm) corresponding to a salinity of about 30 parts per thousand (ppt) which is close to seawater. The conductivity near the surface was 8.1 mS/cm, corresponding to a salinity of approximately 4.5 ppt which is nearly freshwater. Field conditions made it difficult to accurately measure precise depth of the stratified layer transition from saltwater to freshwater, but the water column appears to be well stratified rather than having a gradual linear density pycnocline. As discussed in Section 6.3 below, the effects of stratification do not have a measurable influence on the discharge plume mixing characteristics because the warm effluent density difference buoyancy effects dominated over of the effects of salinity on water column density.

4.5 Other Receiving Conditions

Other receiving water parameters required for CORMIX modeling are summarized on Table 4.2 below. The manning's N value of 0.020 is for a smooth earthen channel with no weeds, as was observed in the field. This is the low end of the range allowed in CORMIX. The wind speed was based on summary weather observations at Lincoln City for the fall season.

Table 4.2 - Other Receiving Water Parameters

Parameter	CORMIX Variable	Value	Units
Manning's n	-	0.020	-
Wind Velocity	UW	4 to 11	mph
Stratification Condition	STRCND	U	--

Notes/Abbreviations:

mph = miles per hour

U = Unstratified, see discussion of sensitivity analysis in Section 6.3.

The Manning's number for the modeling is based on field observation of the bottom conditions (and probing with a staff gauge) in the vicinity of the outfall and corresponds to a clean and straight natural river with little stones and weeds. Manning's number was increased to 0.03 to determine the sensitivity analysis in the model. Wind velocity was varied in the sensitivity analysis to assess impact of wind speed, but is assumed to be low to be conservative.

Section 5: Discharge Characteristics

Critical condition discharge characteristics are defined in the IMD. These characteristics are used in the model to calculate the effluent flow and velocity at the point of discharge. The mixing study used Discharge Monitoring Reports (DMR) effluent flow and temperature data to characterize the discharge, which is summarized below.

5.1 Effluent Flow and Temperature

The discharge characteristics for each facility were combined to estimate the overall critical conditions for the modeling.

5.1.1 Flow

Flow statistics are for the period of discharge to the river only and are based on the last three years of Discharge Monitoring Data (Appendix B). The City operates with discharge flows greater than 85 percent (%) of their Dry Weather Design Flow (DWDF) during the dry season. Per the IMD, the effluent flow for the acute condition was calculated using the DWDR times a Peaking Factor (dry season). The resulting calculated effluent peak flow is 7 million gallons per day (MGD). However, based on the discharge data, the WWTP does not actually discharge flows of this magnitude. Hence, we modeled the acute effluent flow using the max summer flow of 3.55 MGD. These effluent flows are summarized on Table 5.1 below.

Table 5.1 - Summary of Effluent Flow Data

Criteria	Effluent Condition	Effluent Flow (MGD)
Aquatic Life : Acute	Max average daily flow ¹	3.55
Aquatic Life : Chronic	Dry Weather Design Flow	3.0
Human Health)	Dry Weather Design Flow	3.0

Note:

1. Maximum summer WWTP effluent flow between May-2013 to July-2016.

5.1.2 Temperature

Effluent temperature data for the period of discharge were compiled from Discharge Monitoring Reports (Appendix B) for the last three years. The combined discharge temperature was calculated on a flow-weighted basis. The effluent temperature during the late summer period is warmer than the receiving water and, thus, has a strong effect on the mixing characteristics because the effluent is less dense than the receiving water and, therefore, exhibits buoyancy.

The following effluent temperatures in Table 5.2 were used for the modeling.

Table 5.2 - Critical Effluent Temperatures

Criteria	Combined Temperature
Acute (90 th percentile of daily max)	73.4 °F
Chronic (average daily)	69.8 °F
Human Health (Annual average)	64.2 °F

As part of the sensitivity analysis (see Section 3) the receiving water temperatures were varied over the expected range based on STARFLOW meter to assess the impact of the model results under the temperature (and therefore density) differences between the effluent and receiving water.

Section 6: Mixing Zone Modeling

Kennedy/Jenks used CORMIX Version 4.1 G and the CORMIX 3 Buoyant Surface Discharges Port Discharge modeling mode (EPA 1996) to estimate effluent mixing under the acute, chronic, and human health critical conditions. The CORMIX model was chosen because it includes stratification, which occurs during high tide in estuaries near the Schooner Creek outfall.

6.1 Discussion of Modeling Issues

The CORMIX 3 model of open channel flow was applied to the mixing study because, under critical conditions, the effluent pipe is not fully submerged and, therefore, acts more like an open channel than a submerged single port diffuser. This approach is consistent with previous modeling efforts for the discharge (Wells and Annear, 2001) that found CORMIX 3 open channel modeling was most consistent with previous dye studies of the outfall (DEA 1994).

6.2 Chronic and Human Health Conditions

One change made to accommodate the modeling of chronic and human health conditions was using the average depth corresponding to the critical flow instead of the MLLW as recommended in the IMD. This change should not impact the results as there is no predicted bottom interaction with the discharge. The model was also compiled using various depths and the results indicate that the discharge depth did not affect the model results. The model predicted that the discharge plume, under critical conditions, impinged on the 20 foot regulatory mixing zone width in the horizontal direction within 20 feet downstream of the outfall, regardless of the ambient depth. Likely, buoyancy and the effluent velocity caused the effluent stream to rise to the surface of Schooner Creek and spread horizontally near the surface of the river.

6.3 Acute Conditions

In addition, receiving water velocity and depth under acute conditions could not be modeled because, during lowest tide periods lasting approximately four hours, there was very little measureable flow due to a sand bar upstream of the outfall that deflected the Creek flow away from the outfall.

To address this issue and assess potential mixing of hyporheic flow in the streambed, Kennedy/Jenks collected temperature data that can be used along with effluent flow data to estimate the acute mixing.

The following temperature and flow measurements were made during a low tide condition on 30 August 2016. Data for these measurements are included in the spreadsheets in Appendix B.

- Effluent Flow (day's average) (Q_e) = 1.03 MGD = 1.91 cubic feet per second
- Effluent Temperature (T_e) = 21.6 degrees Celsius ($^{\circ}\text{C}$)
- Receiving water temperature upstream of the discharge (T_r) = 14.7 $^{\circ}\text{C}$

- Receiving water temperature at edge of acute mixing zone, 20 feet downstream (T_{mz}) = 21.3 °C

The relationship for conservative temperature mixing:

$$(T_e * Q_e + T_r * Q_r) / (Q_e + Q_r) = T_{mz}$$

Can be rearranged and solved for the receiving flow that is mixed with the effluent (Q_r):

$$Q_r = (T_e * Q_e - T_{mz} * Q_e) / (T_{mz} - T_r)$$

For the parameters listed above, the amount of receiving water mixing with the effluent is 0.084 cubic feet per second (CFS).

This estimated mixing flow was used to estimate the dilution factor (DF) by the following relationship:

$$DF = (Q_r + Q_e) / Q_e$$

$$DF = (0.084 + 191) / 191 = 1.04$$

The field measurements were made during a typical low receiving flow condition. However the effluent flow is lower than the recommended flow in the IMD. However, the measured flow is more typical of the summer to fall transition period when receiving water flow is lowest and tidal influence is dominant and, therefore, can be considered representative of acute conditions.

6.4 Modeling Results

The results of the mixing modeling are summarized on Table 6.1 below and discharge plumes are depicted on Figures 4 and 5. The model predicted that the plume centerline reached regulatory mixing zone width (a 20 foot band from the point of discharge) within about 160 feet for the Chronic Condition and about 125 feet for the Human Health Condition downstream of the outfall. This is a result of the initial discharge velocity momentum being perpendicular to the relatively low stream velocity. To be conservative, the results from this point are also reported in Table 6.1 below.

These dilution factors are based on a strict interpretation of the regulatory mixing zone assigned to the discharge being parallel with the stream bank.

The model was unable to model the effluent plume under acute conditions. Kennedy/Jenks used flow and temperature data obtained on 30 August 2016 to estimate Schooner Creek's dilution contribution to the effluent as discussed in Section 6.1 above.

Table 6.1 - Summary of Modeling Results

Condition	DF at 20-ft (width)	DF when Centerline meets MZ	DF at 200-ft MZ (length)
Acute ¹	1.04	NA	NA
Chronic	1.8	3.5	4.1
Human Health	1.9	3.2	3.9

Note/Abbreviations:

- The acute condition was calculated and not modeled in Cormix. (Section 6.1)
All chronic and human health dilutions are hydrodynamic centerline dilutions.
DF = dilution factor
MZ = mixing zone
NA = not applicable

6.5 Sensitivity Analysis

The modeling included sensitivity analysis for receiving water temperatures described in Section 4.2. The receiving temperature appears to make little difference in the modeling results as plume buoyancy remains the dominant mixing influence the near field. To be protective, the lowest mixing result for each temperature condition was used as the recommended dilution factor.

The wind speed was varied in the model from the original 2 to 5 meters per second (m/s) (4.5 to 11.2 mph) for the 59.9 °F modeling conditions. The results, included in Appendix C, were unchanged when the wind speed was reduced to the low range or even zero. This is as would be expected because the mixing modes related buoyance and surface spreading are dominant in the near field and are initially unaffected by surface turbulence.

The model runs also included sensitivity analysis that modeled both high and low tides using stratified and uniform ambient parameters. The impact of the tides is described in Section 6.1. The results, included in Appendix C, were practically unchanged when whether the model was stratified or uniform. This is as would be expected due to the buoyancy of the plume resulting from the large temperature difference between the effluent and receiving water that is present under both stratified and un-stratified conditions. Kennedy/Jenks is recommending using the slightly lower dilution factors associated with the unstratified condition to be conservative, and to be consistent with lower freshwater water quality standards likely to be applied to the WWTP discharge.

The sensitivity analysis summary is shown below in Table 6.2.

Table 6.2 – Sensitivity Analysis

Parameter	Result
Vary Wind Speed	Increase in wind speed minimally increase DF , used lower conservative wind speed
Reduce Schooner Creek Temperature	Negligible Change
Variance in the stratification depth	Negligible Change
Increase Manning's N to 0.025	Negligible Change

6.6 Modeled Dilutions

. The modeled dilution factors given in Table 6.2 below are the most reasonably conservative results Kennedy/Jenks was able to model. We believe mixing at the actual regulatory mixing zones is probably much better, but because of the conditions, cannot be numerically modeled with CORMIX or other mixing models.

Acute conditions were modeled using temperature and flow data collected on 30 August 2016 discussed in Section 6.2.

Table 6.3 - Dilution Factors

Condition	Centerline Dilution Factor At Edge of Mixing Zone
Acute	1.04
Chronic	3.5
Human Health	3.2

References

- Cutthroat Consulting 2012.** *Schooner Creek Final Report*, Prepared for Salmon Drift Creek Watershed Council, John Sanchez, Cutthroat Country Consulting, 2012
(www.salmondrift.org/2012_April%20Schooner%20Creek%20Habitat%20Assessment%20Final%20Report_John%20Sanchez.pdf)
- DEA 1994.** *Mixing Zone Study Report for Effluent Discharges into Schooner Creek*, Prepared for Lincoln City, Oregon, David Evans and Associates, 3 August 1994.
- DEQ 2013.** *Oregon Department of Environmental Quality (DEQ) Regulatory Mixing Zone Internal Management Directive, Part Two, Mixing Zone Studies*, Oregon Department of Environmental Quality 2013.
- EPA 1996.** *User's Manual for CORMIX: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges Into Surface Waters* Office of Science and Technology, U.S. Environmental Protection Agency Washington, DC 20460, September 1996.
- Wells and Annear 2001.** *Modeling the Lincoln City Outfall into Schooner Creek*, Prepared for Richwine Environmental, Scott A. Wells and Robert Annear, 30 October 2001.

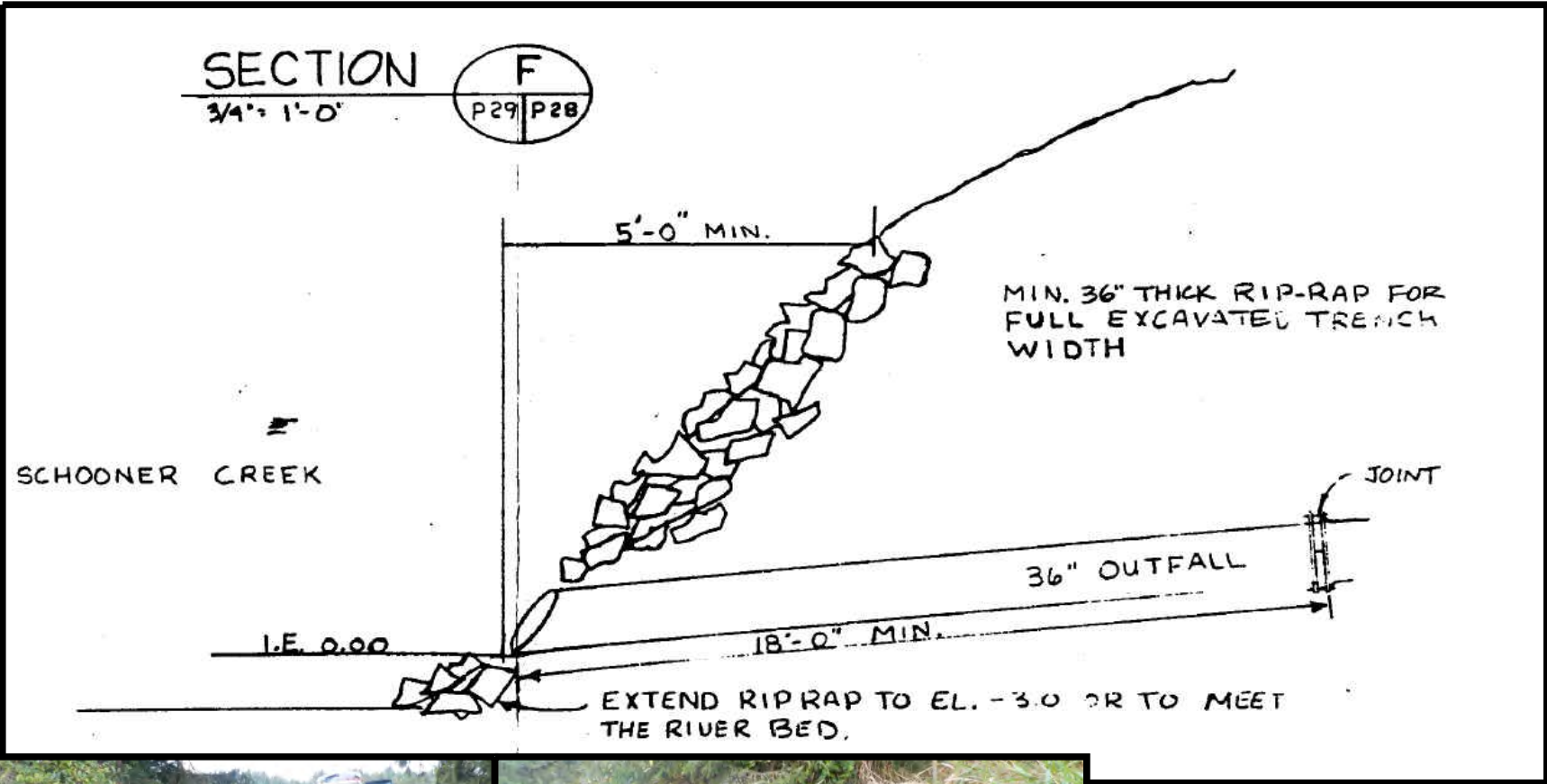
Figures



Kennedy/Jenks Consultants

LINCOLN CITY
WASTEWATER TREATMENT PLANT
MIXING ZONE STUDY
OUTFALL LOCATION

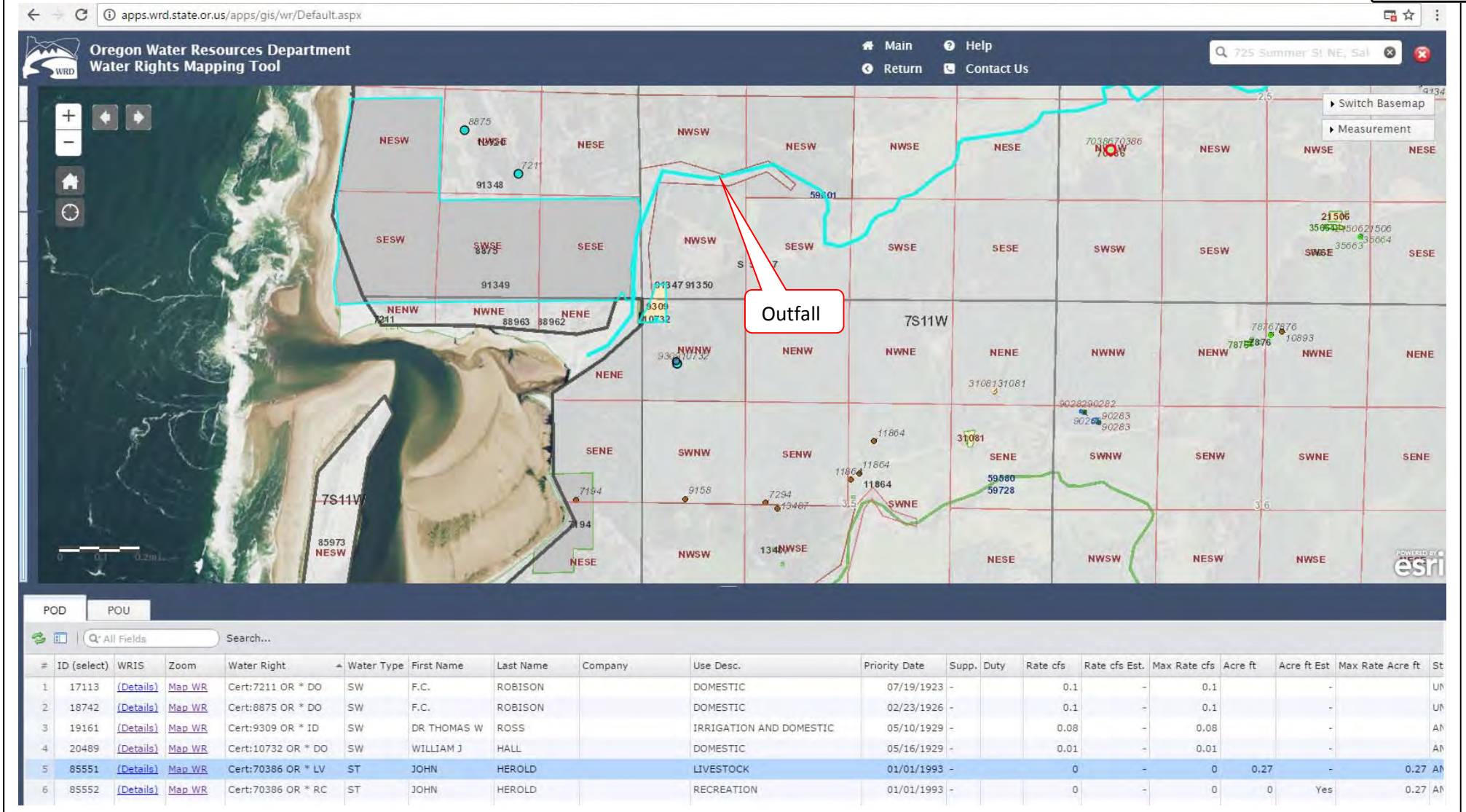
1676017*00
DECEMBER 2016



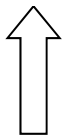
Kennedy/Jenks Consultants

LINCOLN CITY
WASTEWATER TREATMENT PLANT
MIXING ZONE STUDY
OUTFALL DETAILS

1676017*00
DECEMBER 2016

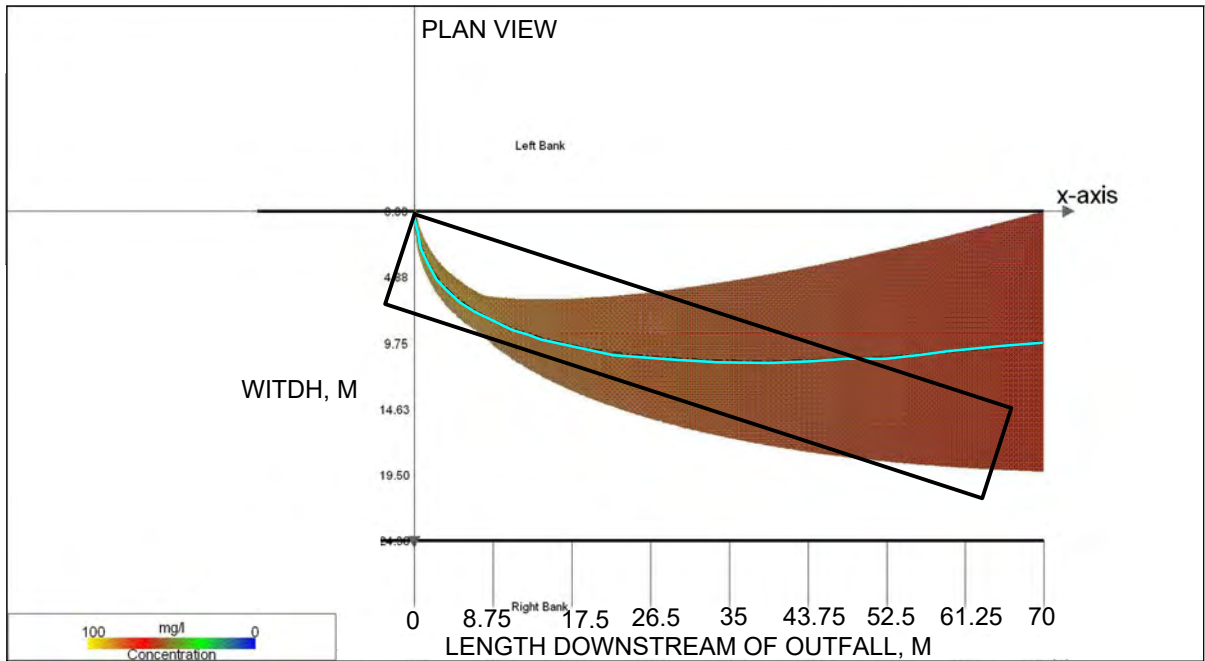


North



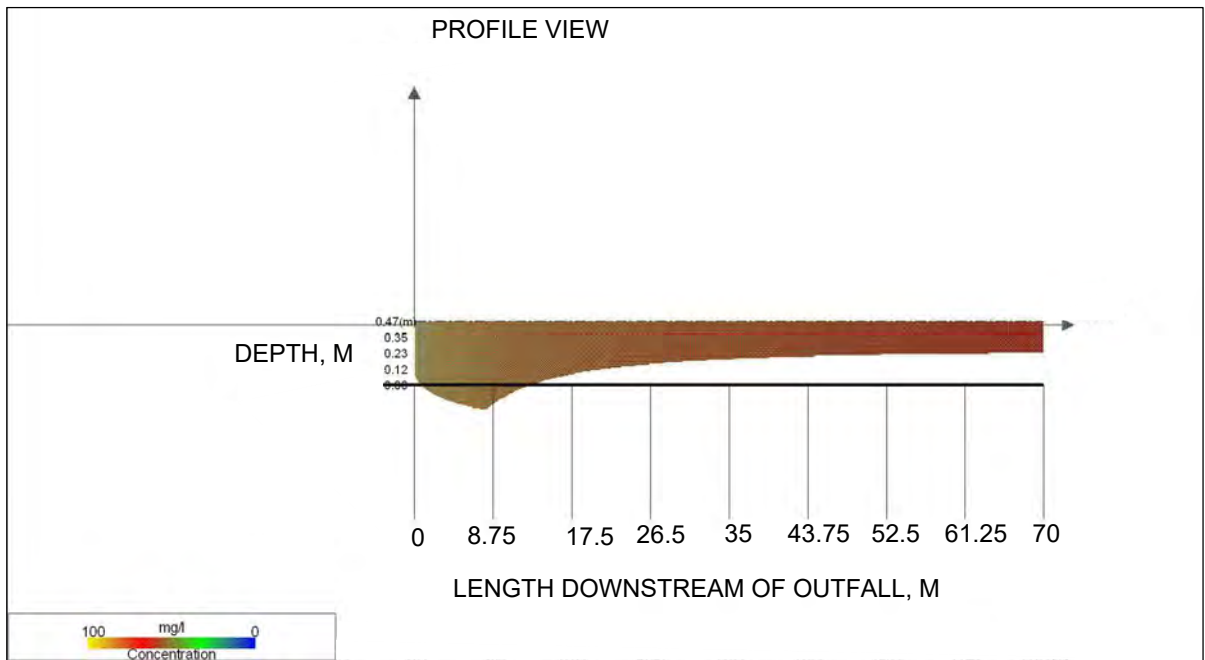
Kennedy/Jenks Consultants
 LINCOLN CITY
 OUTFALL VICINITY WATER RIGHTS
 K/J 1476014*00

FIGURE 3



LEGEND

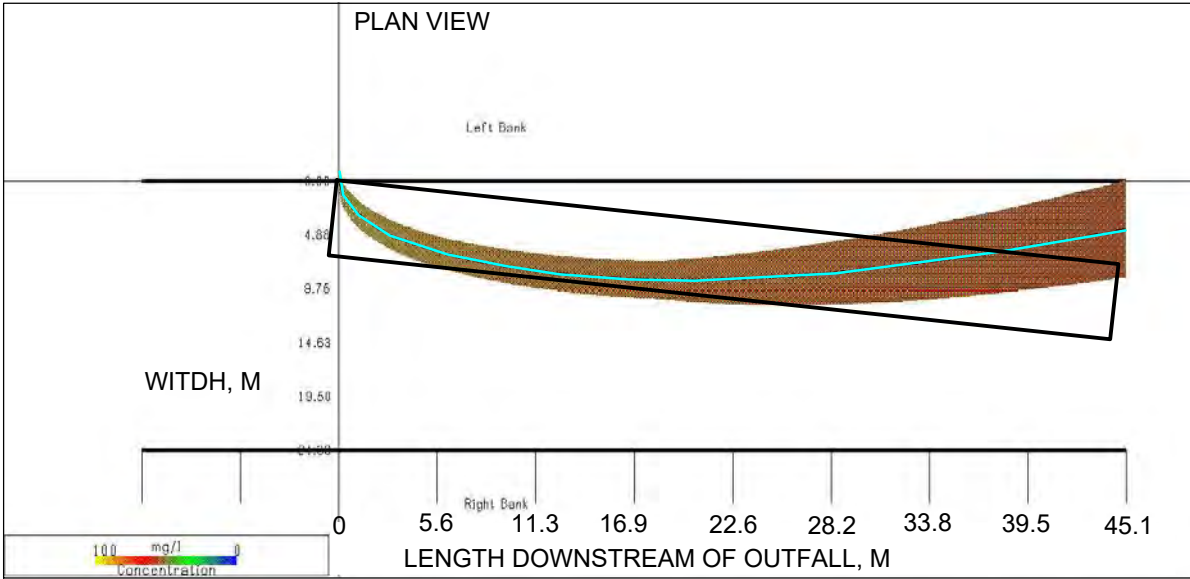
- PLUME CENTERLINE
- ▭ REGULATORY MIXING ZONE



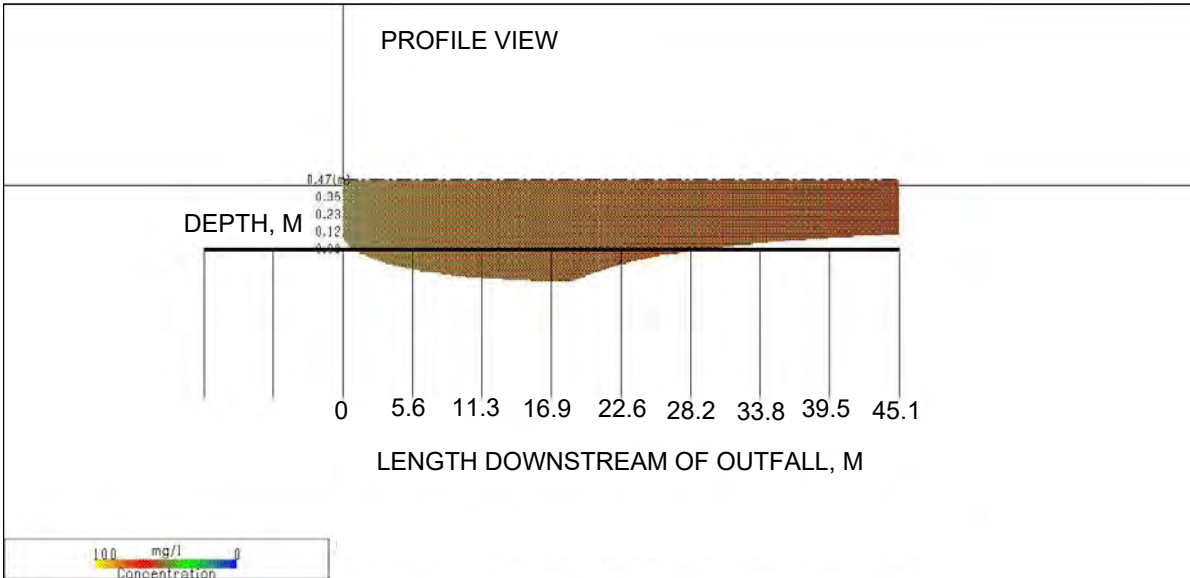
Kennedy/Jenks Consultants

LINCOLN CITY
WASTEWATER TREATMENT FACILITY
MIXING ZONE STUDY
**PLUME DIMENSIONS
CHRONIC CONDITION**

1676017*00
DECEMBER 2016



LEGEND
— PLUME CENTERLINE
▭ REGULATORY MIXING ZONE



Kennedy/Jenks Consultants

LINCOLN CITY
WASTEWATER TREATMENT FACILITY
MIXING ZONE STUDY
PLUME DIMENSIONS
HUMAN HEALTH CONDITION

1676017*00
DECEMBER 2016

Appendix A

Current NPDES Permit

Not Current

Appendix B

Flow Gauge and Measurement Raw Data, and Discharge Data
(CD with Excel Files)

Appendix C

CORMIX Session and Prediction Files Output
(CD)

Attachment 2

City of Lincoln City - DEQ NPDES Permit #101122



Oregon

Kate Brown, Governor

Department of Environmental Quality
 Western Region Salem Office
 4026 Fairview Industrial Drive SE
 Salem, OR 97302
 (503) 378-8240
 FAX (503) 373-7944
 TTY 711

June 30, 2020

Ronald Chandler
 City Manager
 City of Lincoln City
 P.O. Box 50
 Lincoln City, OR 97367-0050

RECEIVED
 JUL 06 2020

BY: _____

CERTIFIED MAIL #7018 0680 0001 9353 7411
RETURN RECEIPT REQUESTED

RE: Issuance of NPDES Permit # 101122
 File # 50677
 EPA # OR0020478
 Facility: Lincoln City STP, 5000 SE Port, Lincoln City
 Lincoln County

Your National Pollutant Disposal Elimination System Permit has been renewed and is enclosed. This permit is DEQ's final action on permit renewal application #974306. DEQ received public comments and the following changes were made to the proposed permit. Please see the response to comment document enclosed for more detail.

- Table B3 was updated to remove total aluminum monitoring from the effluent monitoring requirements.
- Ammonia and hardness monitoring requirement was updated to 2 per week.
- Language was added to Schedule D to allow the permittee to continue accepting hauled waste and a date to submit a Hauled Waste Control Plan.

Your permit is effective on August 1, 2020. Please read your permit carefully. Compliance with your permit is required at all times.

If you are dissatisfied with the conditions of this permit, you have 20 days to request a hearing before the Environmental Quality Commission or its authorized representative. A request for a hearing must be made in writing and state the grounds for the request. Any hearing will be conducted as a contested case hearing in accordance with ORS 183.413 through 183.470 and OAR chapter 340, division 011. If a hearing is requested, the existing permit continues in effect until a final order is issued.

Please note that your required operator certification levels are no longer listed on the face page of your permit. Pursuant to OAR chapter 340, division 049 your systems are classified as follows:

- Collection System: Class III
- Treatment System: Class IV

City of Lincoln City NPDES Permit Renewal
June 30, 2020
Page 2 of 2

If changes are made to your systems or if you have additional questions about operator certification requirements, please contact the DEQ Operator Certification program at opc@deq.state.or.us or 503-229-5349. Current classifications for all systems requiring certified operators may be found at <https://www.oregon.gov/deq/wq/wqpermits/Pages/Wastewater-Operator-Certification.aspx>.

If you have any questions about your permit requirements please contact Steve McMillan at 541-686-7799 or mcmillan.steve@deq.state.or.us.

Sincerely,



Ranei Nomura
Water Quality Manager
Western Region

RN:jmt

Enclosure: Permit, Permit Fact Sheet, and Response to Comments

cc: WQ Permit Coordinator Files, Salem DEQ
Regional File, Eugene DEQ
ec: Steve McMillan, Eugene Office
DEQ Date Team, w/permit
EPA, Seattle w/ permit
DEQ Wastewater Operator Certification Program
ORMS

Expiration Date: June 30, 2025
 EPA Ref. Number: OR0020478
 Permit Number: 101122
 File Number: 50677
 Page 1 of 46 Pages



NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT

Oregon Department of Environmental Quality
 Western Region – Salem Office
 4026 Fairview Industrial Dr. SE
 Salem, OR 97302
 Telephone: 503-378-8240

Issued pursuant to ORS 468B.050 and the Federal Water Pollution Control Act (the Clean Water Act)

ISSUED TO:

City of Lincoln City
 PO Box 50
 Lincoln City, OR 97367

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	Schooner Creek Lat. 44.93274444 Long. -124.00555556 River Mile 1.1
Recycled Water Reuse	002	Specified in Recycled Water Use Plan
Biosolids	N/A	Specified in Biosolids Management/Land Application Plan

FACILITY LOCATION:

5000 SE Port
 Lincoln City, OR 97367
 County: Lincoln

EPA Permit Type: Major

RECEIVING STREAM INFORMATION:

WRD Basin: Mid Coast
 USGS Sub-Basin: Siletz/Yaquina
 Receiving Stream Name: Schooner Creek
 NHD Reach Code: 17100204000208 - 22.18%
 LLID: 1240202449262-RM 1.1

Issued in response to Application No. 974306 received June 29, 2007. This permit is issued based on the land use findings in the permit record.

Ranei Nomura
 Ranei Nomura, Water Quality Manager
 Western Region

June 30, 2020
 Issuance Date

August 1, 2020
 Effective Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to: 1) operate a wastewater collection, treatment, control and disposal system; and 2) discharge treated wastewater to waters of the state only from the authorized discharge point or points in Schedule A in conformance with the requirements, limits, and conditions set forth in this permit.

Unless specifically authorized by this permit, by another NPDES or Water Pollution Control Facility permit, or by Oregon statute or administrative rule, any other direct or indirect discharge of pollutants to waters of the state is prohibited.

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SCHEDULE A: WASTE DISCHARGE LIMITS

1. Outfall 001 – Permit Limits

During the term of this permit, the permittee must comply with the limits in the following table:

Table A1: Permit Limits

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD ₅ (May 1 – October 31)	mg/L	10	15	
	lbs/day	250	380	500
	% removal	85		
TSS (May 1 – October 31)	mg/L	10	15	
	lbs/day	250	380	500
	% removal	85		
BOD ₅ (November 1 – April 30)	mg/L	20	30	
	lbs/day	750	1100	1500
	%	85		
TSS (November 1 – April 30)	mg/L	20	30	
	lbs/day	750	1100	1500
	%	85		
pH	SU	Instantaneous limit between a daily minimum of 6.2 and a daily maximum of 9.0		
Fecal Coliform (marine and estuarine shellfish growing waters) See note a.	#/100 mL	Interim limit = Must not exceed 126 organisms monthly geometric mean and no single sample shall exceed 406 organisms per 100 mL. Final limit = Must not exceed a monthly median of 56 organisms per 100 mL, not more than 10% of the samples collected in a calendar month may exceed 172 organisms per 100 mL.		
Total Ammonia Nitrogen	mg/L	5.3		12.2
Excess Thermal Load See note b.	million kcal/day	Interim limit = 31 as a 7-day rolling average Final limit = 10.7 as a 7-day rolling average		
Total Recoverable Copper See note c.	µg/L	1.8		3.1
Total Recoverable Zinc See note d.	µg/L	37.1		64.3

Notes:

- a. The interim fecal coliform bacteria limit will become effective upon permit issuance. The final fecal coliform bacteria limit shall become effective after completion of the compliance schedule in SCHEDULE C. While under the interim limit, if a single sample exceeds 406 organisms per 100 mL, five consecutive re-samples may be taken at intervals between two and four hours beginning 28 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation of the interim limit will not be triggered.
- b. The interim Excess Thermal Load Limit will become effective upon permit issuance. The final Excess Thermal Load limit will become effective after completion of the compliance schedule in Schedule C.
- c. The Total Recoverable Copper limit will become effective upon completion of the compliance schedule in Schedule C.
- d. The Total Recoverable Zinc limit will become effective upon completion of the compliance schedule in Schedule C.

Average dry weather design flow for the existing facility equals 2.1 MGD. Summer mass load limits are based upon average dry weather design flow of the prior facility of 3.0 MGD. Winter mass load limits are based upon average wet weather design flow of the prior facility equaling 4.5 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 6 MGD (twice the average dry weather design flow of the prior facility).

2. Regulatory Mixing Zone

Pursuant to OAR 340-041-0053, the permittee is granted a regulatory mixing zone as described below:

The allowable mixing zone is that portion of Schooner Creek extending two hundred (200) feet upstream and downstream from the point of discharge. The Zone of Immediate Dilution (ZID) is that portion of the allowable mixing zone that is within twenty (20) feet of the point of discharge.

3. Use of Recycled Water

The permittee is authorized to distribute recycled water if it is:

- a. Treated and used according to the criteria listed in Table A2.
- b. Managed in accordance with its DEQ-approved Recycled Water Use Plan unless exempt as provided in Schedule D.
- c. Used in a manner and applied at a rate that does not adversely affect groundwater quality.
- d. Applied at a rate and in accordance with site management practices that ensure continued agricultural, horticultural, or silvicultural production and does not reduce the productivity of the site.
- e. Irrigated using sound irrigation practices to prevent:
 - i. Offsite surface runoff or subsurface drainage through drainage tile;
 - ii. Creation of odors, fly and mosquito breeding, or other nuisance conditions; and
 - iii. Overloading of land with nutrients, organics, or other pollutants.

Table A2: Recycled Water Limits

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
A	<p>Class A recycled water must be oxidized, filtered and disinfected. Before disinfection, unless otherwise approved in writing by DEQ turbidity may not exceed:</p> <ul style="list-style-type: none"> • An average of 2 NTUs within a 24-hour period. • 5 NTUs more than five percent of the time within a 24-hour period. • 10 NTUs at any time. <p>After disinfection, total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 2.2 organisms per 100 mL based on daily sampling over the last 7 days that analyses have been completed. • 23 organisms per 100 mL in any single sample. 	<p>Class A recycled water may be used for:</p> <ul style="list-style-type: none"> • Classes B, C and D, and non-disinfected uses. • Irrigation for any agricultural or horticultural use. • Landscape irrigation of parks, playgrounds, schoolyards, residential landscapes, or other landscapes accessible to the public. • Commercial car washing or fountains when the water is not intended for human consumption. • Water supply source for non-restricted recreational impoundments.
B	<p>Class B recycled water must be oxidized and disinfected. Total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 2.2 organisms per 100 mL, based on the last 7 days that analyses have been completed. • 23 total coliform organisms per 100 mL in any single sample. 	<p>Class B recycled water may be used for:</p> <ul style="list-style-type: none"> • Classes C and D, and non-disinfected uses. • Stand-alone fire suppression systems in commercial and residential building, non-residential toilet or urinal flushing, or floor drain trap priming. • Water supply source for restricted recreational impoundments.
C	<p>Class C recycled water must be oxidized and disinfected. Total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 23 total coliform organisms per 100 mL, based on results of the last 7 days that analyses have been completed. • 240 total coliform organisms per 100 mL in any two consecutive samples. 	<p>Class C recycled water may be used for:</p> <ul style="list-style-type: none"> • Class D and non-disinfected uses. • Irrigation of processed food crops; irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil. • Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses. • Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural firefighting using aircraft, street sweeping, or sanitary sewer flushing.

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Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
D	Class D recycled water must be oxidized and disinfected. <i>E. coli</i> may not exceed: <ul style="list-style-type: none"> • A 30-day geometric mean of 126 organisms per 100 mL. • 406 organisms per 100 mL in any single sample. 	Class D recycled water may be used for: <ul style="list-style-type: none"> • Nondisinfected uses. • Irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals.
Nondisinfected	Nondisinfected recycled water must be oxidized.	Nondisinfected water may be used for: Irrigation for growing commercial timber, fodder, fiber or seed crops not intended for human ingestion.

4. Biosolids

The permittee may land apply biosolids or provide biosolids for sale or distribution, subject to the following conditions:

- a. The permittee must manage biosolids in accordance with its DEQ-approved Biosolids Management Plan and Land Application Plan.
- b. The permittee must apply biosolids at or below the agronomic rates approved by DEQ in order to minimize potential groundwater degradation.
- c. The permittee must obtain written site authorization from DEQ for each land application site prior to land application (see Schedule D) and follow the site-specific management conditions in the DEQ-issued site authorization letter.
- d. Prior to application, the permittee must ensure that biosolids meet one of the pathogen reduction standards under 40 CFR 503.32 and one of the vector attraction reduction standards under 40 CFR 503.33.
- e. The permittee must not apply biosolids containing pollutants in excess of the ceiling concentrations shown in the table below. The permittee may apply biosolids containing pollutants in excess of the pollutant concentrations, but below the ceiling concentrations, the total quantity of biosolids applied cannot exceed the cumulative pollutant loading rates in the table below.

Table A3: Biosolids Limits

Pollutant See Note a.	Ceiling concentrations (mg/kg)	Pollutant concentrations (mg/kg)	Cumulative pollutant loading rates (kg/ha)
Arsenic	75	41	41
Cadmium	85	39	39
Copper	4300	1500	1500
Lead	840	300	300
Mercury	57	17	17
Molybdenum	75	N/A	N/A
Nickel	420	420	420
Selenium	100	100	100
Zinc	7500	2800	2800

Note:

- a. Biosolids pollutant limits are described in 40 CFR 503.13, which uses the terms *ceiling concentrations*, *pollutant concentrations*, and *cumulative pollutant loading rates*.

5. Chlorine Usage

The permittee is prohibited from using chlorine or chlorine compounds for effluent disinfection purposes. Chlorine residual in effluent resulting from chlorine or chlorine-containing chemicals used for maintenance or other purposes is also prohibited.

6. Mercury Minimization Plan

By the date listed in Table B1, the permittee must submit an MMP (Mercury Minimization Plan) to DEQ for review and approval. At a minimum, the MMP must include the following:

- a. Identification and evaluation of current and potential mercury (both methyl mercury [MeHg] and total mercury) sources
- b. Identification and evaluation of conditions (e.g., anaerobic conditions) that might contribute to the methylation of elemental mercury in the collection and treatment systems
- c. Identification of industrial, commercial and residential sources of mercury
- d. A monitoring plan to confirm current or potential sources of mercury (Monitoring Plan)
- e. Identification of potential methods for reducing or eliminating mercury. These may include but are not limited to:
 - i. Best Management Practices requirements or limits for industrial and commercial sources of mercury to a collection system
 - ii. Material substitution
 - iii. Material recovery
 - iv. Spill control and collection
 - v. Waste recycling
 - vi. Process modifications

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- vii. Laboratory housekeeping, use and disposal practices and
 - viii. Public education.
- f. Ongoing monitoring of effluent to enable evaluation of the effectiveness and implementation of the MMP.

Within 60 days of receiving DEQ comments on the MMP, the permittee must revise the plan to be consistent with DEQ's comments and resubmit for DEQ approval. Before approving the plan, DEQ will put the plan out on public notice. The permittee must use a DEQ-approved template unless authorized in writing by DEQ to use an alternative. The permittee must begin implementation of the approved plan within 30 days of DEQ's approval. If DEQ determines that the MMP is not effective at reducing sources of mercury from entering its collection system, or if a water column translation of the fish tissue criterion is developed, DEQ may reopen the permit to modify the permit conditions. These modifications may include, but are not limited to, the addition of a numeric effluent limit.

SCHEDULE B: MINIMUM MONITORING AND REPORTING REQUIREMENTS

1. Reporting Requirements

The permittee must submit to DEQ monitoring results and reports as listed below.

Table B1: Reporting Requirements and Due Dates

Reporting Requirement	Frequency	Due Date (See Note a.)	Report Form (See Note b.)	Submit To:
Tables B2 and B3 Influent Monitoring and Effluent Monitoring	Monthly	By the 15 th of the following month	Specified in Schedule B. Section 2 of this permit	Electronic reporting as directed by DEQ
Table B4: Copper Biotic Ligand Model and Aluminum Sampling Requirements	Aluminum: Monthly for first 24 months after permit effective date. Copper: Monthly for first six months after permit effective date.	By the 15 th of the following month	Electronic copy in a DEQ- approved format	Attached via electronic reporting as directed by DEQ
Tables B5 – B8: Effluent Toxics Characterization	Quarterly for each of the first 4 quarters after permit effective date	Within 45 days following the end of each quarter	Electronic copy in a DEQ- approved format	Attached via electronic reporting as directed by DEQ
Table B9: WET Test Monitoring	Minimum of 4 times per every 5 years. See note c.	With the first DMR submittal after receipt of the test results	Electronic copy in a DEQ- approved format	Attached via electronic reporting as directed by DEQ
Recycled Water Annual Report (see SCHEDULE D)	Annually	January 15	Electronic copy in the DEQ- approved format	Attached via electronic reporting as directed by DEQ Electronic copy to DEQ Water Reuse Program Coordinator
Biosolids annual report (See Schedule D)	Annually	February 19	Electronic copy in the DEQ- approved form	Attached via electronic reporting as directed by DEQ DEQ Biosolids Program Coordinator
Inflow and infiltration report (see Schedule D)	Annually	February 15	Electronic copy in a DEQ- approved format	Attached via electronic reporting as directed by DEQ

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Reporting Requirement	Frequency	Due Date (See Note a.)	Report Form (See Note b.)	Submit To:
Hauled Waste Control Plan (See Schedule D)	One time	Submit by no later than 6 months after permit effective date	Electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ
Hauled Waste Annual Report (See Schedule D)	Annually	January 15	Electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ
Industrial User Survey (see Schedule D)	Every 5 years	Submit by no later than 24 months after permit effective date	1 electronic copy and 1 hard copy in a DEQ-approved format	<ul style="list-style-type: none"> • 1 Hard copy to DEQ Pretreatment Coordinator • 1 Electronic copy to Compliance Officer
Outfall Inspection Report (see Schedule D)	Once per permit cycle	Submit by December 12, 2023	Electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ
Mercury Minimization Plan (see Schedule A)	One time	Submit by May 15, 2022	One electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ

Notes:

- a. For submittals that are provided to DEQ by mail, the postmarked date must not be later than the due date.
- b. All reporting requirements are to be submitted in a DEQ-approved format, unless otherwise specified in writing.
- c. Each test will be conducted during a different quarter each year (e.g., Year 1, Qtr. 1). When possible, conduct the first WET testing concurrent with Effluent Toxics Characterization Monitoring in the first year of the permit term. All tests must be completed prior to submission of renewal application.

2. Monitoring and Reporting Protocols

a. Electronic Submissions

The permittee must submit to DEQ the results of monitoring indicated in SCHEDULE B in an electronic format as specified below.

- i. When directed by DEQ, the permittee must submit monitoring results required by this permit via DEQ-approved web-based Discharge Monitoring Report (DMR) forms to DEQ via electronic reporting. Any data used to calculate summary statistics must be submitted as a separate attachment approved by DEQ via electronic reporting.
- ii. The reporting period is the calendar month.
- iii. The permittee must submit monitoring data and other information required by this permit for all compliance points by the 15th day of the month following the reporting period unless specified otherwise in this permit or as specified in writing by DEQ.

b. Test Methods

The permittee must conduct monitoring according to test procedures in 40 CFR 136 and 40 CFR 503 for biosolids or other approved procedures as per SCHEDULE F.

c. **Detection and Quantitation Limits**

- i. Detection Level (DL) – The DL is defined as the minimum measured concentration of a substance that can be distinguished from method blank results with 99% confidence. The DL is derived using the procedure in 40 CFR Part 136 Appendix B and evaluated for reasonableness relative to method blank concentrations to ensure results reported above the DL are not a result of routine background contamination. The DL is also known as the Method Detection Limit (MDL) or Limit of Detection (LOD).
- ii. Quantitation Limits (QLs) – The QL is the minimum level, concentration or quantity of a target analyte that can be reported with a specified degree of confidence. It is the lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration for the analyte. It is normally equivalent to the concentration of the lowest calibration standard adjusted for sample weights, volumes, preparation and cleanup procedures employed. The QL as reported by a laboratory is also referred to as the Method Reporting Limit (MRL) or Limit of Quantitation (LOQ).
- iii. For compliance and characterization purposes, the maximum acceptable QL is stated in this permit.

d. **Implementation**

The Laboratory QLs (adjusted for any dilutions) for analyses performed to demonstrate compliance with permit limits or as part of effluent characterization, must be at or below the QLs specified in the permit unless one of the conditions below is met.

- i. The monitoring result shows a detect above the laboratory reported QL.
- ii. The monitoring result indicates non-detect at a DL that is less than the QL.
- iii. Matrix effects are present that prevent the attainment of QLs. These matrix effects are demonstrated according to procedures described in EPA's *Solutions to Analytical Chemistry Problems with Clean Water Act Methods*, March 2007. If using alternative methods and taking appropriate steps to eliminate matrix effects does not eliminate the matrix problems, DEQ may authorize in writing re-sampling or allow a higher QL to be reported. In the case of effluent characterization monitoring, DEQ may allow the re-sampling to be done as part of Tier 2 monitoring. Schedule B contains more information on Tier 1 and Tier 2 monitoring.

e. **Quality Assurance and Quality Control**

- i. Quality Assurance Plan – The permittee must develop and implement a written Quality Assurance Plan that details the facility sampling procedures, equipment calibration and maintenance, analytical methods, quality control activities and laboratory data handling and reporting. The QA/QC program must conform to the requirements of 40 CFR 136.7.
- ii. If QA/QC requirements are not met for any analysis, the permittee must re-analyze the sample. If the sample cannot be re-analyzed, the permittee must re-sample and analyze at the earliest opportunity. If the permittee is unable to collect a sample that meets QA/QC requirements, then the permittee must include the result in the discharge monitoring report (DMR) along with a notation (data qualifier). In addition, the permittee must explain how the sample does not meet QA/QC requirements. The permittee may not use the result that failed the QA/QC requirements in any calculation required by the permit unless authorized in writing by DEQ.

- iii. Flow measurement, field measurement, and continuous monitoring devices - The permittee must:
 - (A) Establish verification and calibration frequency for each device or instrument in the quality assurance plan that conforms to the frequencies recommended by the manufacturer.
 - (B) Verify at least once per year that flow-monitoring devices are functioning properly according to manufacturer's recommendation. Calibrate as needed according to manufacturer's recommendations.
 - (C) Verify at least weekly that the continuous monitoring instruments are functioning properly according to manufacturer's recommendation unless the permittee demonstrates a longer period is sufficient and such longer period is approved by DEQ in writing.
- iv. The permittee must develop a receiving water sampling and analysis plan that incorporates QA/QC prior to sampling. This plan must be kept at the facility and made available to DEQ upon request.

f. **Reporting Sample Results**

- i. The permittee must report the laboratory DL and QL as defined above for each analyte, with the following exceptions: pH, temperature, BOD, CBOD, TSS, Oil & Grease, hardness, alkalinity, bacteriological analytes and nitrate-nitrite. For temperature and pH, neither the QL nor the DL need to be reported. For the other parameters listed above, the permittee is only required to report the QL and only when the result is ND.
- ii. The permittee must report the same number of significant digits as the permit limit for a given parameter.
- iii. Chemical Abstracts Service (CAS) Numbers. CAS numbers (where available) must be reported along with monitoring results.
- iv. (For Discharge Monitoring Reports) If a sample result is above the DL but below the QL, the permittee must report the result as the DL preceded by DEQ's data code "e". For example, if the DL is 1.0 µg/l, the QL is 3.0 µg/L and the result is estimated to be between the DL and QL, the permittee must report "e1.0 µg/L" on the DMR. This requirement does not apply in the case of parameters for which the DL does not have to be reported.
- v. (For Discharge Monitoring Reports) If the sample result is below the DL, the permittee must report the result as less than the specified DL. For example, if the DL is 1.0 µg/L and the result is ND, report "<1.0" on the discharge monitoring report (DMR). This requirement does not apply in the case of parameters for which the DL does not have to be reported.

g. **Calculating and Reporting Mass Loads**

The permittee must calculate mass loads on each day the parameter is monitored using the following equation:

$$\text{Flow (in MGD)} \times \text{Concentration (in mg/L)} \times 8.34 = \text{Pounds per day}$$

- i. Mass load limits all have two significant figures unless otherwise noted.

- ii. When concentration data are below the DL: To calculate the mass load from this result, use the DL. Report the mass load as less than the calculated mass load. For example, if flow is 2 MGD and the reported sample result is $<1.0 \mu\text{g/L}$, report “ $<0.02 \text{ lb/day}$ ” for mass load on the DMR ($1.0 \mu\text{g/L} \times 2 \text{ MGD} \times \text{conversion factor} = 0.017 \text{ lb/day}$, round off to 0.02 lb/day).
- iii. When concentration data are above the DL, but below the QL: To calculate the mass load from this result, use the detection level. Report the mass load as the calculated mass load preceded by “e”. For example, if flow is 2 MGD and the reported sample result is $e1.0 \mu\text{g/L}$, report “ $e0.02 \text{ lb/day}$ ” for mass load on the DMR ($1.0 \mu\text{g/L} \times 2 \text{ MGD} \times \text{conversion factor} = 0.017 \text{ lb/day}$, round off to 0.02 lb/day).

3. Monitoring and Reporting Requirements

- a. The permittee must take influent grab and composite samples and measurements upstream of the SBR and report results in accordance with the table below:

Table B2: Influent Monitoring Requirements

Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type / Required Action See note a.	Report Statistic See note b.
Flow (50050)	MGD	Year-round	Daily	Metered	Monthly Average Daily Maximum
BOD ₅ (00310)	mg/L	Year-round	2/week	24-hour composite	Monthly Average
TSS (00530)	mg/L	Year-round	2/week	24-hour composite	Monthly Average
pH (00400)	SU	Year-round	Daily	Grab	Monthly Maximum Monthly Minimum

Notes:

- a. In the event of equipment failure or loss, the permittee must notify DEQ and deploy new equipment to minimize interruption of data collection. If new equipment cannot be immediately deployed, the permittee must monitor grab measurements daily between 7 am and 5 pm until monitoring equipment is redeployed.
- b. When submitting DMRs electronically, the permittee must submit all data used to determine summary statistics in a DEQ approved format as a spreadsheet via electronic reporting unless otherwise directed by DEQ.

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- b. The permittee must monitor effluent at Outfall 001 immediately downstream of the UV disinfection unit and report results in accordance with Table B1 and the table below:

Table B3: Effluent Monitoring Requirements

Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type/ Required Action See note a.	Report Statistic See note b.
Flow (50050)	MGD	Year-round	Daily	Metered	Monthly Average Daily Maximum
BOD ₅ (00310)	mg/L	Year-round	2/week	24-hour composite	Monthly Average Weekly Average
BOD ₅ (00310)	lbs/day	Year-round	2/week	Calculation	Daily Maximum Monthly Average Weekly Average
BOD ₅ Percent Removal See note b. (81010)	%	Year-round	Monthly	Calculation based on monthly average BOD ₅ concentration values	Monthly Average
TSS (00530)	mg/L	Year-round	2/week	24-hour composite	Monthly Average Weekly Average
TSS (00530)	lbs/day	Year-round	2/week	Calculation	Daily Maximum Monthly Average Weekly Average
TSS Percent Removal (81011) See note b.	%	Year-round	Monthly	Calculation based on monthly average TSS concentration values	Monthly Average

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Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type/ Required Action See note a.	Report Statistic See note b.
pH (00400)	SU	Year-round	Daily	Grab	Daily Maximum Daily Minimum
Temperature (00010)	°C	Year-round	Daily	Measurement	Daily Maximum Monthly Average Maximum 7-day Rolling Average of Daily Maximum
Excess Thermal Load (51405)	million kcal/day	Year-round	Daily	Calculation (see note d)	Maximum 7-day Rolling Average
Fecal Coliform (74055)	#/100 mL	Year-round	3/week	Grab	<i>Interim Limits:</i> Monthly Geomean Daily Maximum <i>Final Limits:</i> Monthly Median
Fecal Coliform (30500)	%	Year-round	Monthly	Calculation	<i>Final Limits:</i> Monthly Percent Samples Over 172
Total Recoverable Zinc (01094)	µg/L	Year-round	1/month	24-hour composite	Daily Maximum Monthly Average
Total Recoverable Copper (01042)	µg/L	Year-round	1/month	24-hour composite	Monthly Average Daily Maximum
Total Ammonia (as N) (00610)	mg/L	Year-round	2/week	24-hour composite	Monthly Average Daily Maximum
Hardness (00900)	mg/L	Year-round	2/week	24-hour composite	Monthly Maximum
UV dose (61938)	mJ/cm ²	Year-round	Daily	Calculation	Daily Minimum
Mercury, Total Recoverable (MMP) (71900)	ng/L	Years 1 and 5 of the permit. See note c.	Quarterly	24-hour composite	Monthly Average Monthly Maximum
Dissolved Oxygen (00300)	mg/L	Third year of permit cycle, year 2023	Quarterly	Grab	Quarterly Minimum
Total Kjeldahl Nitrogen (TKN) (00625)	mg/L	Third year of permit cycle, year 2023	Quarterly	Grab	Quarterly Maximum

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Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type/ Required Action See note a.	Report Statistic See note b.
Nitrate (NO ₃) Plus Nitrite (NO ₂) Nitrogen (00630)	mg/L	Third year of permit cycle, year 2023	Quarterly	Grab	Quarterly Maximum
Oil and Grease (00556)	mg/L	Third year of permit cycle, year 2023	Quarterly	Grab	Quarterly Maximum
Total Phosphorus (00665)	mg/L	Third year of permit cycle, year 2023	Quarterly	Grab	Quarterly Maximum
Total Dissolved Solids (70295)	mg/L	Third year of permit cycle, year 2023	Quarterly	Grab	Quarterly Maximum

Notes:

- a. In the event of equipment failure or loss, the permittee must notify DEQ and deploy new equipment to minimize interruption of data collection. If new equipment cannot be immediately deployed, the permittee must monitor grab measurements daily, preferably between 7 am and 5 pm, unless circumstances determine otherwise until monitoring equipment is redeployed.

- b. Percent Removal must be calculated on a monthly basis using the following formula:

$$\text{Percent Removal} = \frac{[\text{Influent Concentration}] - [\text{Effluent Concentration}]}{[\text{Influent Concentration}]} \times 100$$

Where:

Influent Concentration = Corresponding monthly average influent concentration based on the analytical results of the reporting period.

Effluent Concentration = Corresponding monthly average effluent concentration based on the analytical results of the reporting period.

- c. First and last 4 quarters of the permit term. Total of 8 samples.
- d. The daily excess thermal load (ETL) discharged must be calculated using the daily maximum effluent temperature and the corresponding daily average effluent flow using the formula below. If the calculation results in an ETL value less than zero, the results must be recorded as zero.

The 7-day rolling average is then calculated from the daily ETLs.

The daily ETL is calculated as follows: $ETL = 3.785 * Q_e * \Delta T$

Where:

ETL = Excess Thermal Load (million kcal/day)

Q_e = Daily Average Effluent flow (MGD)

ΔT = Daily Maximum Effluent temperature (°C) minus ambient criterion (18°C)

4. Copper Biotic Ligand Model and Aluminum Parameters

The permittee must monitor Schooner Creek and Outfall 001 for copper biotic ligand model and aluminum parameters per the table below. The permittee must collect upstream samples such that the effluent does not impact the samples (e.g., upstream for riverine discharges).

Table B4: Copper Biotic Ligand Model and Aluminum Sampling Requirements

Parameter See note b.	CAS See note f.	Units	Sampling Frequency See note c.	Sampling Location See note a.
Copper, Total and Dissolved See note e, f and g.	7440508	µg/L	1/month	Upstream and Effluent
Aluminum, Total See note d.	7429905	µg/L	1/month	Upstream and Effluent
Hardness (as CaCO ₃)	N/A	mg/L	1/month	Upstream and Effluent
Dissolved Organic Carbon	N/A	mg/L	1/month	Upstream and Effluent
pH	N/A	S.U.	1/month	Upstream and Effluent
Temperature	N/A	°C	1/month	Upstream and Effluent
Calcium, dissolved	7440702	mg/L	1/month	Upstream and Effluent
Magnesium, dissolved	7439954	mg/L	1/month	Upstream and Effluent
Sodium, dissolved	7440235	mg/L	1/month	Upstream and Effluent
Potassium, dissolved	7440097	mg/L	1/month	Upstream and Effluent
Sulfate, dissolved	14808798	mg/L	1/month	Upstream and Effluent
Chloride, dissolved	16887006	mg/L	1/month	Upstream and Effluent
Alkalinity, dissolved	N/A	mg/L	1/month	Upstream and Effluent

Notes:

- Samples must be collected upstream (outside the influence of the effluent) and from the effluent on the same day.
- All effluent samples must be 24-hr composite samples except grab samples must be collected for pH, alkalinity and temperature. All receiving stream samples must be grab samples.
- Samples must be collected monthly for a period of 24 months beginning 30 days after permit effective date (See Note g. below)..
- QL is 50.0 µg/L for aluminum
- QL is 2.0 µg/L for copper
- Chemical Abstract Service
- Prior to permit issuance, the permittee has collected 18 monthly copper samples to date. Upon permit issuance, the permittee will be required to collect six (6) additional monthly copper samples for a total of 24 monthly copper samples. If the permittee determines based on the requirements of the Compliance Schedule in this permit that the only way to comply with the final copper limit requires relocating the outfall, then the permittee will be required to collect an additional 24 monthly samples at the new outfall location.

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5. Effluent Toxics Characterization Monitoring (Tier 1 Monitoring)

The permittee must collect and analyze effluent samples for the parameters listed in the tables below. The permittee must collect effluent samples at a specific location such as at the end of the active chlorine contact channel on the dates in Table B1.

Samples must be 24-hour composites, except as noted in the tables below for total cyanide, free cyanide and volatile organic compounds. Sample results must be submitted to DEQ using approved electronic format.

Table B5: Metals, Cyanide, and Hardness
 (µg/L unless otherwise specified)

Pollutant See note a.	CAS See note b.	QL	Pollutant See note a.	CAS See note b.	QL
Antimony (total)	7440360	0.50	Lead (total and dissolved)	7439921	1.0
Arsenic (total)	7440382	0.50	Mercury (total)	7439976	0.001
Arsenic (Total Inorganic)	7440382	1.0	Nickel (total and dissolved)	7440020	10
Arsenic (Total Inorganic Dissolved)	7440382	1.0	Selenium (total and dissolved)	7782492	1.0
Beryllium (total)	7440417	0.10	Silver (total and dissolved)	7440224	10
Cadmium (total and dissolved)	7440439	0.10	Thallium (total)	7440280	0.10
Chromium (total)	7440473	0.40	Zinc (total and dissolved)	7440666	5.0
Chromium III (total and dissolved)	16065831	N/A	Cyanide (free) See note c. & d.	57125	5.0
Chromium VI (total and dissolved)	18540299	2.0	Cyanide (total) See note d.	57125	5.0
			Hardness (total as CaCO ₃)		

Notes:

- The term "total" used in reference to metals is intended to cover all EPA-accepted standard digestion methods and is considered equivalent to the term "total recoverable".
- Chemical Abstract Service
- There are multiple approved methods for testing for free cyanide. For more information, refer to DEQ's analytical memo on the subject of cyanide monitoring at <https://www.oregon.gov/deq/FilterDocs/sToxicscyanide.pdf>
- When sampling for cyanide (free and total), the permittee must collect at least six discrete grab samples over the operating day with samples collected no less than one hour apart. The aliquot must be at least 100 mL and collected and composited into a larger container that has been preserved with sodium hydroxide to insure sample integrity. If the result for Total Cyanide exceeds 5.0 µg/L, the permittee must monitor for free cyanide as part of the Tier 2 monitoring.

Table B6: Volatile Organic Compounds
 (µg/L unless otherwise specified)

Pollutant See note a.	CAS	QL	Pollutant See note a.	CAS	QL
Acrolein See note k.	107028	5.0	1,2-trans-dichloroethylene See note d.	156605	0.50
Acrylonitrile See note k.	107131	5.0	1,1-dichloroethylene See note e.	75354	0.50
Benzene	71432	0.50	1,2-dichloropropane	78875	0.50
Bromoform	75252	0.50	1,3-dichloropropylene See note f.	542756	0.50
Carbon Tetrachloride	56235	0.50	Ethylbenzene	100414	0.50
Chlorobenzene	108907	0.50	Methyl Bromide See note g.	74839	1.00
Chlorodibromomethane See note b.	124481	0.50	Methyl Chloride See note h.	74873	1.00
Chloroethane	75003	0.50	Methylene Chloride	75092	2.00
2-Chloroethylvinyl Ether See note k.	110758	10	1,1,2,2-tetrachloroethane	79345	0.50
Chloroform	67663	0.50	Tetrachloroethylene See note i.	127184	0.50
Dichlorobromomethane See note c.	75274	0.50	Toluene	108883	0.50
1,2-Dichlorobenzene (o)	95501	0.50	1,1,1-trichloroethane	71556	0.50
1,3-Dichlorobenzene (m)	541731	0.50	1,1,2-trichloroethane	79005	0.50
1,4-Dichlorobenzene (p)	106467	0.50	Trichloroethylene See note j.	79016	0.50
1,1-dichloroethane	75343	0.50	Vinyl Chloride	75014	0.50
1,2-dichloroethane	107062	0.50			

Notes:

- a. The permittee must collect six discrete samples (not less than 40 mL) over the operating day at intervals of at least one hour. The samples may be analyzed separately or composited. If analyzed separately, the analytical results for all samples must be averaged for reporting purposes. If composited, they must be composited in the laboratory at the time of analysis in a manner that maintains the integrity of the samples and prevents the loss of volatile analytes. The quantitation limits listed above remain in effect for composite samples.
- b. Chlorodibromomethane is identified as Dibromochloromethane in 40 CFR 136.3, Table 1C.
- c. Dichlorobromomethane is identified as Bromodichloromethane in 40 CFR 136.3, Table 1C.
- d. 1,2-Trans-dichloroethylene is identified as Trans-1,2-dichloroethene in 40 CFR 136.3, Table 1C.
- e. 1,1-Dichloroethylene is identified as 1,1-Dichloroethene in 40 CFR 136.3, Table 1C.
- f. 1,3-Dichloropropylene consists of both cis-1,3-Dichloropropene and Trans-1,3-dichloropropene. Both should be reported individually.
- g. Methyl bromide is identified as Bromomethane in 40 CFR 136.3, Table 1C.
- h. Methyl chloride is identified as Chloromethane in 40 CFR 136.3, Table 1C.
- i. Tetrachloroethylene is identified as Tetrachloroethene in 40 CFR 136.3, Table 1C.
- j. Trichloroethylene is identified as Trichloroethene in 40 CFR 136.3, Table 1C.
- k. Acrolein, Acrylonitrile, and 2-Chloroethylvinyl ether must be tested from an unacidified sample.

Table B7: Acid-Extractable Compounds
 (µg/L unless otherwise specified)

Pollutant	CAS	QL See note a.	Pollutant	CAS	QL See note a.
p-chloro-m-cresol See note b.	59507	1.0	2-nitrophenol	88755	2.0
2-chlorophenol	95578	1.0	4-nitrophenol	100027	5.0
2,4-dichlorophenol	120832	1.0	Pentachlorophenol	87865	1.0
2,4-dimethylphenol	105679	5.0	Phenol	108952	1.0
4,6-dinitro-o-cresol See note c.	534521	2.0	2,4,5-trichlorophenol See note d.	95954	2.0
2,4-dinitrophenol	51285	5.0	2,4,6-trichlorophenol	88062	1.0

Notes:

- Some QLs may need methods with modification allowed in 40 CFR 136.6 or EPA's *Solutions for Analytical Chemistry Problems with Clean Water Methods*, March 2007.
- p-chloro-m-cresol is identified as 4-Chloro-3-methylphenol in 40 CFR 136.3, Table 1C.
- 4,6-dinitro-o-cresol is identified as 2-Methyl-4,6-dinitrophenol in 40 CFR 136.3, Table 1C.
- To monitor for 2,4,5-trichlorophenol, use EPA Method 625.

Table B8: Base-Neutral Compounds
 (µg/L unless otherwise specified)

Pollutant	CAS	QL See note a.	Pollutant	CAS	QL See note a.
Acenaphthene	83329	1.0	Dimethyl phthalate	131113	1.0
Acenaphthylene	208968	1.0	2,4-dinitrotoluene	121142	1.0
Anthracene	120127	1.0	2,6-dinitrotoluene	606202	1.0
Benzidine	92875	50.0	1,2-diphenylhydrazine (See note d)	122667	5.0
Benzo(a)anthracene	56553	0.5	Fluoranthene	206440	2.0
Benzo(a)pyrene	50328	0.5	Fluorene	86737	1.0
3,4-benzofluoranthene See note b.	205992	0.5	Hexachlorobenzene	118741	1.0
Benzo(ghi)perylene	191242	1.0	Hexachlorobutadiene	87683	2.0
Benzo(k)fluoranthene	207089	0.5	Hexachlorocyclopentadiene	77474	2.0
Bis(2-chloroethoxy)methane	111911	2.0	Hexachloroethane	67721	1.0
Bis(2-chloroethyl)ether	111444	1.0	Indeno(1,2,3-cd)pyrene	193395	0.5
Bis(2-chloroisopropyl)ether See note c.	108601	2.0	Isophorone	78591	5.0
Bis (2-ethylhexyl)phthalate	117817	1.0	Napthalene	91203	1.0
4-bromophenyl phenyl ether	101553	1.0	Nitrobenzene	98953	1.0
Butylbenzyl phthalate	85687	1.0	N-nitrosodi-n-propylamine	621647	2.0

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Pollutant	CAS	QL See note a.	Pollutant	CAS	QL See note a.
2-chloronaphthalene	91587	1.0	N-nitrosodimethylamine	62759	2.0
4-chlorophenyl phenyl ether	7005723	1.0	N-nitrosodiphenylamine	86306	1.0
Chrysene	218019	0.5	Pentachlorobenzene (See note e)	608935	1.0
Di-n-butyl phthalate	84742	1.0	Phenanthrene	85018	1.0
Di-n-octyl phthalate	117840	1.0	Pyrene	129000	1.0
Dibenzo(a,h)anthracene	53703	0.5	1,2,4-trichlorobenzene	120821	1.0
3,3-Dichlorobenzidine	91941	2.0	Tetrachlorobenzene,1,2,4,5 (See note e)	95943	1.0
Diethyl phthalate	84662	1.0			

Notes:

- Some QLs may need methods with modification allowed in 40 CFR 136.6 or EPA's *Solutions for Analytical Chemistry Problems w/Clean Water Methods*, March 2007.
- 3,4-benzofluoranthene is listed as Benzo(b)fluoranthene in 40 CFR 136.
- Bis(2-chloroisopropyl)ether is listed as 2,2'-oxybis(2-chloro-propane) in 40 CFR 136.
- 1,2-diphenylhydrazine is difficult to analyze given its rapid decomposition rate in water. Azobenzene (a decomposition product of 1,2-diphenylhydrazine), should be analyzed as an estimate of this chemical.
- To analyze for Pentachlorobenzene and Tetrachlorobenzene 1,2,4,5, use EPA 625.

6. Additional Receiving Stream and Effluent Characterization Monitoring (Tier 2 Monitoring)

When DEQ evaluates the results of monitoring required under Schedule B, Effluent Toxics Characterization Monitoring (also referred to as Tier 1 monitoring) to determine whether the permittee will be required to conduct additional ambient water quality and/or effluent monitoring (also referred to as Tier 2 monitoring). DEQ will notify the permittee of its determination through a written "Monitoring Action Letter."

7. Whole Effluent Toxicity (WET) Requirements

The permittee must monitor final effluent for whole effluent toxicity as described in the table below using the testing protocols specified in Schedule D. Whole Effluent Toxicity Testing for Freshwater for Outfall 001 must be collected at the location specified below.

Table B9: WET Test Monitoring

Parameter	Sample Type/Location	Minimum Frequency	Report
Acute toxicity	For acute toxicity: Grab taken immediately downstream of the UV disinfection unit.	See Table B1	Report must include test results and backup information such as bench sheets sufficient to demonstrate compliance with permit requirements. Report must include a statement certifying that the results do or do not show toxicity.
Chronic toxicity	For chronic toxicity: 24-hr composite, immediately downstream of the UV disinfection unit and taken after dechlorination and before the effluent flume.		

8. Recycled Water Monitoring Requirements: Outfall 002

The permittee must monitor recycled water for Outfall 002 as listed below. The samples must be representative of the recycled water delivered for beneficial reuse at a location identified in the Recycled Water Use Plan.

Table B10: Recycled Water Monitoring

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Required Action	Report
Total Flow (MGD)	May 1-October 31	Daily	Measurement	1. Daily maximum 2. Monthly average 3. Monthly total
UV dose (mJ/cm ²)	May 1- October 31	Daily	Calculation based on UVI grab and average daily flow	1. Daily maximum 2. Daily minimum 3. Monthly maximum 4. Monthly minimum
pH (SU)	May 1-October 31	3/Week	Grab	1. Daily maximum 2. Daily minimum 3. Monthly maximum 4. Monthly minimum
Total Coliform (See note a)	May- October	Daily (Class A) 3/Week (Class B) Weekly (Class C)	Grab	1. Daily value 2. Monthly median 3. Weekly average 4. Max. weekly average 5. Monthly maximum
<i>E. coli</i>	May 1-October 31	Weekly (Class D)	Grab	1. Daily value 2. Monthly average 3. Weekly average 4. Max. weekly average 5. Monthly maximum
Turbidity	May 1-October 31	Hourly (Class A only)	Measurement	1. Hourly minimum 2. Hourly maximum 3. 24-Hour average

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Required Action	Report
Nitrogen Loading Rate (lbs/acre-year)	May 1-October 31	Annually	Calculation	1. Annual Report
Nutrients (TKN, NO ₂ +NO ₃ -N, Total Ammonia (as N), Total Phosphorus)	May 1-October 31	Quarterly	Grab	1. Daily value 2. Monthly average 3. Monthly maximum
Note:				
a. Calculations of the median total coliform levels in Classes A – C are based on the results of the last seven days that analyses have been completed.				

9. Biosolids Monitoring Requirements

The permittee must monitor biosolids land applied or produced for sale or distribution as listed below. The samples must be representative of the quality and quantity of biosolids generated and undergo the same treatment process used to prepare the biosolids. Results must be reported as required in the biosolids management plan described in SCHEDULE D.

Table B11: Biosolids Monitoring

Item or Parameter	Minimum Frequency	Sample Type
Nutrient and conventional parameters (% dry weight unless otherwise specified): Total Kjeldahl Nitrogen (TKN) Nitrate-Nitrogen (NO ₃ -N) Total Ammonia Nitrogen (NH-N) Total Phosphorus (P) Potassium (K) pH (S.U.) Total Solids Volatile Solids	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B12.	As described in the DEQ-approved Biosolids Management Plan
Pollutants: As, Cd, Cu, Hg, Pb, Mo, Ni, Se, Zn (mg/kg dry weight)	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B12.	As described in the DEQ-approved Biosolids Management Plan
Pathogen reduction	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B12.	As described in the DEQ-approved Biosolids Management Plan

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Item or Parameter	Minimum Frequency	Sample Type
Vector attraction reduction	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B12.	As described in the DEQ-approved Biosolids Management Plan
Record of biosolids land application: date, quantity, location.	Each event	Record the date, quantity, and location of biosolids land applied on site location map or equivalent electronic system, such as GIS.

Table B12: Biosolids Minimum Monitoring Frequency

Quantity of biosolids land applied or produced for sale or distribution per calendar year		Minimum Sampling Frequency
(dry metric tons)	(dry U.S. tons)	
Less than 290	Less than 320	Once per year
290 to 1,500	320 to 1,653	Once per quarter (4x/year)
1500 to 15,000	1,653 to 16,535	Once per 60 days (6x/year)
15,000 or more	16,535 or more	Once per month (12x/year)

SCHEDULE C: COMPLIANCE SCHEDULE

1. Compliance Schedule to Meet Final Effluent Limitations

The permittee must comply with the following schedules:

Table C1: Fecal Coliform Compliance Schedule

Complete By	Requirement
February 15, 2021 and annually thereafter	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final fecal coliform effluent limits.
December 31, 2023	Submit a plan for coming into compliance with the fecal coliform final effluent limits to DEQ for approval.
June 30, 2024	Secure financing for improvements to comply with the fecal coliform final effluent limits.
December 31, 2024	Submit plans for improvements to comply with the fecal coliform final effluent limits.
September 30, 2025	Complete improvements and meet the fecal coliform final effluent limits included in Schedule A.

Table C2: Total Recoverable Copper, Total Recoverable Zinc, and Excess Thermal Load Compliance Schedule

Complete By	Requirement
February 15, 2021 and annually thereafter	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final effluent limitations.
December 31, 2028	Complete a Facility Plan that selects options for improvements to the treatment facility to comply with the copper, zinc and Excess Thermal Load final effluent limits and submit the Facility Plan to DEQ for review and approval.
December 31, 2031	Evaluate and obtain financing for wastewater facility improvements recommended in the Facility Plan.
December 31, 2032	Complete Preliminary Design Report and submit to DEQ for review and approval.
December 31, 2033	Complete Final Design and submit to DEQ for review and approval
October 31, 2037	Complete construction of wastewater facility improvements to comply with the copper, zinc, and Excess Thermal Load final effluent limits.
December 1, 2037	The permittee must achieve compliance with the final effluent limits and provide DEQ with written notice of compliance with the copper, zinc, and Excess Thermal Load final effluent limits in Schedule A.

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2. **Responsibility to Meet Compliance Dates**

No later than 14 days following each compliance date listed in the tables above, the permittee must notify DEQ in writing of its compliance or noncompliance with the requirements. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and a discussion of the likelihood of meeting the next scheduled requirement(s).

3. **Re-opener Clause**

This permit may be re-opened and modified to be consistent with conditions or mitigation measures imposed as a result of EPA's Endangered Species Act consultation with the National Marine Fisheries Service (NMFS) and the US Fish & Wildlife Service (USF&WS) on DEQ's rule authorizing the use of this compliance schedule. If necessary, DEQ will commence modification of this permit by notifying the permittee and seeking public comment on the proposed modifications within two years after the later of (1) the date EPA's re-approval of Oregon's compliance schedules rule becomes final, or (2) the date DEQ completes any required implementation of EPA re-approval, unless the date for completion of implementation exceeds two years from the date of EPA's action, in which case the modifications must commence within a period of four years from the date of EPA's re-approval.

SCHEDULE D: SPECIAL CONDITIONS

1. Inflow and Infiltration

The permittee must submit to DEQ an annual inflow and infiltration report on a DEQ-approved form as directed in Table B1. The report must include the following:

- a. An assessment of the facility's I/I issues based on a comparison of summer and winter flows to the plant.
- b. Details of activities performed in the previous year to identify and reduce inflow and infiltration.
- c. Details of activities planned for the following year to identify and reduce inflow and infiltration.
- d. A summary of sanitary sewer overflows that occurred during the previous year. This should include the following: date of the SSO, location, estimated volume, cause, follow-up actions and if performed, the results of receiving stream monitoring.

2. Emergency Response and Public Notification Plan

The permittee must develop an Emergency Response and Public Notification Plan ("plan"), or ensure the facility's existing plan is current and accurate, per Schedule F, Section B, and Condition 8 within 6 months of permit effective date. The permittee must update the plan annually to ensure all information contained in the plan, including telephone and email contact information for applicable public agencies, is current and accurate. An updated copy of the plan must be kept on file at the facility for DEQ review. The latest plan revision date must be listed on the plan cover along with the reviewer's initials or signature.

3. Recycled Water Use Plan

In order to distribute recycled water, the permittee must develop and maintain a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025. The permittee must submit this plan or any significant modifications to DEQ for review and approval with sufficient time to clear DEQ review and a public notice period prior to distribution of recycled water. The permittee is prohibited from distributing recycled water prior to receipt of written approval of its Recycled Water Use Plan from DEQ. The permittee must keep the plan updated. All plan revisions require written authorization from DEQ and are effective upon permittee's receipt of DEQ written approval. No significant modifications can be made to a plan for an administratively extended permit (after the permit expiration date). Conditions in the plan are enforceable requirements under this permit. DEQ will provide an opportunity for public review and comment on any significant plan modifications prior to approving or denying. Public review is not required for minor modifications, changes to utilization dates or changes in use within the recycled water class.

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- a. Recycled Water Annual Report – The permittee must submit a recycled water annual report by the date specified in Table B1: Reporting Requirements and Due Dates. The permittee must use the DEQ approved recycled water annual report form. This report must include the monitoring data and analytical laboratory reports for the previous year’s monitoring required under Schedule B.

4. Exempt Wastewater Reuse at the Treatment System

Recycled water used for landscape irrigation within the property boundary or in-plant processes at the wastewater treatment system is exempt from the requirements of OAR 340-055 if all of the following conditions are met:

- a. The recycled water is an oxidized and disinfected wastewater.
- b. The recycled water is used at the wastewater treatment system site where it is generated or at an auxiliary wastewater or sludge treatment facility that is subject to the same NPDES or WPCF permit as the wastewater treatment system. Land that is contiguous to the property upon which the treatment system is located is considered to be part of the wastewater treatment system site if under the same ownership.
- c. Spray and/or drift from the use does not migrate off the site.
- d. Public access to the site is restricted.

5. Biosolids Management Plan

The permittee must update and maintain a Biosolids Management Plan and Land Application Plan meeting the requirements in OAR 340-050-0031. The permittee must submit these plans and any significant modification of these plans to DEQ for review and approval with sufficient time to clear DEQ review and a public notice period prior to implementing any significant changes to the biosolids program. The permittee must keep the plans updated. All plan revisions require written authorization from DEQ and are effective upon permittee’s receipt of DEQ written approval. No significant modifications can be made to a plan for an administratively extended permit (after the permit expiration date). Conditions in the plans are enforceable requirements under this permit.

a. Annual Report

The permittee must submit a Biosolids Annual Report by February 19 each year documenting biosolids management activities of the previous calendar year as described in OAR 340-050-0035(6). The permittee must use the DEQ approved Biosolids Annual report form. This report must include the monitoring data and analytical laboratory reports for the previous year’s monitoring specified under Schedule B.

b. Site Authorization

The permittee must obtain written authorization from DEQ for each land application site prior to its use. Conditions in site authorizations are enforceable requirements under this permit. The permittee is prohibited from land applying biosolids to a DEQ-approved site except in accordance with the site authorization, while this permit is effective and with the written approval of the property owner. DEQ may modify or revoke a site authorization following the procedures for a permit modification described in OAR 340-045-0055.

c. Public Participation

- i. DEQ will provide an opportunity for public review and comment on any significant plan modifications prior to approving or denying. Public review is not required for minor modifications or changes to utilization dates.
- ii. No DEQ-initiated public notice is required for continued use of sites identified in the DEQ-approved biosolids management plan.
- iii. For new sites that fail to meet the site selection criteria in the biosolids management plan or that are deemed by DEQ to be sensitive with respect to residential housing, runoff potential, or threat to groundwater, DEQ will provide an opportunity for public comment as directed by OAR 340-050-0015(10).
- iv. For all other new sites, the permittee must provide for public participation following procedures in its DEQ-approved land application plan.

d. Exceptional Quality Biosolids

The permittee is exempt from the requirements in Condition 5.b above, if:

- i. Pollutant concentrations of biosolids are less than the pollutant concentration limits in Schedule A, Table A3;
- ii. Biosolids meet one of the Class A pathogen reduction alternatives in 40 CFR 503.32(a); and
- iii. Biosolids meet one of the vector attraction reduction options in 40 CFR 503.33(b)(1) through (8).

6. Wastewater Solids Transfers

- a. *Within state.* The permittee may transfer wastewater solids including Class A and Class B biosolids, to another facility permitted to process or dispose of wastewater solids, including but not limited to: another wastewater treatment facility, landfill, or incinerator. The permittee must satisfy the requirements of the receiving facility. The permittee must report the name of the receiving facility and the quantity of material transferred in the wastewater solids annual report identified in Schedule B.
- b. *Out of state.* If wastewater solids, including Class A and Class B biosolids, are transferred out of state for use or disposal, the permittee must obtain written authorization from DEQ, meet Oregon requirements for the use or disposal of wastewater solids, notify in writing the receiving state of the proposed use or disposal of wastewater solids, and satisfy the requirements of the receiving state.

7. Hauled Waste Control Plan

The permittee may accept hauled wastes at discharge points designated by the POTW. The permittee must submit a written Hauled Waste Control Plan by the date listed in Table B1. Within 60 days of receiving DEQ comments, the permittee must submit hauled waste control plan revised to be consistent with DEQ's comments. Hauled wastes may include wastewater solids from another wastewater treatment facility, septage, grease trap wastes, potable and chemical toilet wastes, landfill leachate, groundwater remediation wastewaters, and commercial/industrial wastewaters. The permittee must keep the plan updated and submit substantial modifications to an existing plan to DEQ for approval at least 60 days prior to making the proposed changes. Plan modifications are effective upon receipt of written DEQ approval. A Hauled Waste Control Plan is not required in the event biological seed must be added to the process at the POTW to facilitate effective wastewater treatment.

8. Hauled Waste Annual Report

By the date listed in Table B1, the permittee must submit a report of hauled waste received by the POTW. This report must include the date, time, type, and amount received each time the POTW accepts hauled waste. Hauled waste is described in the permittee's Hauled Waste Control Plan.

9. Whole Effluent Toxicity Testing for Freshwater

- a. The permittee must conduct whole effluent toxicity (WET) tests as specified here and in SCHEDULE B of this permit.
- b. Acute Toxicity Testing - Organisms and Protocols
 - i. The permittee must conduct 48-hour static renewal tests with *Ceriodaphnia dubia* (water flea) and 96-hour static renewal tests with *Pimephales promelas* (fathead minnow).
 - ii. All test methods and procedures must be in accordance with *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition, EPA-821-R-02-012, October 2002*, or the most recent version of this publication if such edition is available. If the permittee wants to deviate from the bioassay procedures outlined in this method, the permittee must submit a written request to DEQ for review and approval prior to use.
 - iii. Treatments to the final effluent samples (for example, dechlorination, ammonia removal), except those included as part of the methodology, may not be performed by the laboratory unless approved by DEQ in writing prior to analysis.
 - iv. WET acute testing must be conducted using a dilution series based upon the effluent percentage at the ZID (EPZID) in the following manner: 100%; (EPZID+100)/2%; EPZID%; EPZID/2%; and EPZID/4% and a control (0% effluent).

 The dilution series includes the effluent percentage (equal to 100/dilution) that is expected at the edge of the ZID, as well as the effluent percentages above and below this value. For example, if the dilution at the ZID is 2.5, the EPZID is 40%, and the appropriate dilution series would be 100%, 70%, 40%, 20%, 10% effluent and lab control. Note: if the ZID dilution = 1, then use the following dilution series: 0%, 6.25%, 12.5%, 25%, 50%, and 100% effluent.
 - v. An acute WET test shows toxicity if there is a statistically significant difference in survival between the control and 50 % effluent.
- c. Chronic Toxicity Testing - Organisms and Protocols
 - i. The permittee must conduct tests with *Ceriodaphnia dubia* (water flea) for reproduction and survival test endpoint, *Pimephales promelas* (fathead minnow) for growth and survival test endpoint, and *Raphidocelis subcapitata* (green alga formerly known as *Selanastrum capricornutum*) for growth test endpoint.
 - ii. All test methods and procedures must be in accordance with *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, EPA-821-R-02-013, October 2002*. If the permittee wants to deviate from the bioassay procedures outlined in the applicable method, the permittee must submit a written request to DEQ for review and approval prior to use.
 - iii. Treatments to the final effluent samples (for example, dechlorination, ammonia removal), except those included as part of the methodology, may not be performed by the laboratory unless approved by DEQ in writing prior to analysis.

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- iv. WET chronic testing must be conducted using a dilution series based upon the effluent percentage at the RMZ (EPRMZ) in the following manner: 100% effluent; (EPRMZ+100)/2%; EPRMZ%; EPRMZ/2%; and EPRMZ/4% and a control (0% effluent).

The dilution series includes the effluent percentage (equal to 100/dilution) that is expected at the edge of the RMZ, as well as the effluent percentages above and below this value. For example, if the dilution at the edge of the RMZ is 10, the EPRMZ is 10%, and the appropriate dilution series would be 100%, 55%, 10%, 5%, 2.5% effluent and lab control. Note: if there is no mixing zone, then use the following dilution series: 6.25%, 12.5%, 25%, 50%, and 100% effluent and a control (0% effluent).

- v. A chronic WET test shows toxicity if the IC25 (25% inhibition concentration) occurs at dilutions equal to or less than the dilution that is known to occur at the edge of the mixing zone, that is, $IC25 \leq 25\%$.

d. Dual End-Point Tests

- i. WET tests may be dual end-point tests in which both acute and chronic end-points can be determined from the results of a single chronic test. The acute end-point will be based on 48-hours for the *Ceriodaphnia dubia* (water flea) and 96-hours for the *Pimephales promelas* (fathead minnow).
- ii. All test methods and procedures must be in accordance with *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, EPA-821-R-02-013, October 2002*. If the permittee wants to deviate from the bioassay procedures outlined in this method, the permittee must submit a written request to DEQ for review and approval prior to use.
- iii. Tests run as dual end-point tests must be conducted on a control (0%) and the following dilution series: 6.25%, 12.5%, 25%, 50%, and 100% effluent.
- iv. Toxicity determinations for dual end-point tests must correspond to the acute and chronic tests described in conditions 9.b.v and 9.c.v above.

e. Sampling Requirements

At the time of WET sampling, the permittee must collect and analyze effluent samples for total and dissolved metals, cyanide, phenols, and hardness.

f. Evaluation of Causes and Exceedances

- i. If any test exhibits toxicity as described in conditions 9.b.v. and 9.c.v. above, the permittee must conduct another toxicity test using the same species and DEQ-approved methodology within two weeks unless an extension is granted by DEQ in writing.
- ii. If two consecutive WET test results indicate acute or chronic toxicity as described in conditions 9.b.v. and 9.c.v. above, the permittee must immediately notify DEQ of the results. DEQ will work with the permittee to determine the appropriate course of action to evaluate and address the toxicity.

g. Quality Assurance and Reporting

- i. Quality assurance criteria, statistical analyses, and data reporting for the WET tests must be in accordance with the EPA documents stated in this condition.

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- ii. For each test, the permittee must provide a bioassay laboratory report according to the EPA method documents referenced in this Schedule. The report must include all QA/QC documentation, statistical analysis for each test performed, standard reference toxicant test (SRT) conducted on each species required for the toxicity tests, and completed Chain of Custody forms for the samples including time of sample collection and receipt. The permittee must submit reports to DEQ within 60 days of test completion.
 - iii. The report must include all endpoints measured in the test: NOEC (No Observed Effects Concentration), LOEC (Lowest Observed Effects Concentration), and IC₂₅ (chronic effect 25% inhibition concentration).
 - iv. The permittee must make available to DEQ upon request the written standard operating procedures they, or the laboratory performing the WET tests, use for all toxicity tests required by DEQ.
- h. Reopener
- DEQ may reopen and modify this permit to include new limits, monitoring requirements, and/or conditions as determined by DEQ to be appropriate, and in accordance with procedures outlined in OAR Chapter 340, Division 45 if:
- i. WET testing data indicate acute and/or chronic toxicity.
 - ii. The facility undergoes any process changes.
 - iii. Discharge monitoring data indicate a change in the reasonable potential to cause or contribute to an exceedance of a water quality standard.
- i. Circumstances not addressed in this section, or that require deviation from the requirements of this section, must be approved in writing by DEQ before changes are implemented.

10. Operator Certification

- a. Definitions
 - i. "Supervise" means to have full and active responsibility for the daily on site technical operation of a wastewater treatment system or wastewater collection system.
 - ii. "Supervisor" or "designated operator" means the operator delegated authority by the permittee for establishing and executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system in accordance with the policies of the owner of the system and any permit requirements.
 - iii. "Shift Supervisor" means the operator delegated authority by the permittee for executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system when the system is operated on more than one daily shift.
 - iv. "System" includes both the collection system and the treatment systems.
- b. The permittee must comply with OAR Chapter 340, Division 49, "Regulations Pertaining to Certification of Wastewater System Operator Personnel" and designate a supervisor whose certification corresponds with the classification of the collection and/or treatment system as specified on the Wastewater System Classification Worksheet in the fact sheet for this permit (including renewals and modifications). DEQ may revise the permittee's classification in writing at any time to reflect changes in the collection or treatment system. This reclassification is not considered a permit modification and may be made after the permit expiration date,

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provided the permit has been administratively extended by DEQ. If a facility is re-classified, a certified letter will be mailed to the system owner from the DEQ Operator Certification Program. Current system classifications are publicized on the DEQ Supervisory Wastewater Operator Status Report found on the DEQ Wastewater Operator Certification Homepage.

- c. The permittee must have its system supervised full-time by one or more operators who hold a valid certificate for the type of wastewater treatment or wastewater collection system, and at a grade equal to or greater than the wastewater system's classification.
- d. The permittee's wastewater system may be without the designated supervisor for up to 30 consecutive days if another person supervises the system, who is certified at no more than one grade lower than the classification of the wastewater system. The permittee must delegate authority to this operator to supervise the operation of the system.
- e. If the wastewater system has more than one daily shift, the permittee must have another properly certified operator available to supervise operation of the system. Each shift supervisor must be certified at no more than one grade lower than the system classification.
- f. The permittee is not required to have a supervisor on site at all times; however, the supervisor must be available to the permittee and operator at all times.
- g. The permittee must notify DEQ in writing of the name of the system supervisor by completing and submitting the Supervisory Wastewater System Operator Designation Form. The most recent version of this form is found on the DEQ Wastewater Operator Certification homepage *NOTE: This form is different from the Delegated Authority form. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of the operator in charge. As of this writing, the notice of replacement or re-designation must be sent to Water Quality Division, Operator Certification Program, 700 NE Multnomah St, Suite 600, Portland, OR 97232-4100. This address may be updated in writing by DEQ during the term of this permit.
- h. When compliance with item (d) of this section is not possible or practicable because the system supervisor is not available or the position is vacated unexpectedly, and another certified operator is not qualified to assume supervisory responsibility, the Director may grant a time extension for compliance with the requirements in response to a written request from the system owner. The Director will not grant an extension longer than 120 days unless the system owner documents the existence of extraordinary circumstances.

11. Spill/Emergency Response Plan

The permittee must have an up-to-date spill response plan for prevention and handling of spills and unplanned discharges. This plan must be available for review during a DEQ inspection. The spill response plan must include all of the following:

- a. A description of the reporting system that will be used to alert responsible managers and legal authorities in the event of a spill.
- b. A description of preventive measures and facilities (including an overall facility plot showing drainage patterns) to prevent, contain, or treat spills.
- c. A description of the permittee's training program to ensure that employees are properly trained at all times to respond to unplanned and emergency incidents.
- d. A description of the applicable reporting requirements. These must be consistent with the reporting requirements found in Schedule F, condition D.5.

12. Industrial User Survey

- a. By the date listed in Table B1, the permittee must conduct an industrial user survey as described in 40 CFR 403.8(f)(2)(i-iii) to determine the presence of any industrial users discharging wastewaters subject to pretreatment and submit a report on the findings to DEQ. The purpose of the survey is to identify whether there are any industrial users discharging to the POTW, and ensure regulatory oversight of these discharges to state waters.
- b. Should DEQ determine that a pretreatment program is required, the permit must be reopened and modified in accordance with 40 CFR 403.8(e)(1) to incorporate a compliance schedule for development of a pretreatment program. The compliance schedule must be developed in accordance with the provisions of 40 CFR 403.12(k), and must not exceed twelve (12) months.

13. Outfall Inspection

During the year 2023 (3rd year after permit issuance), the permittee must inspect outfall 001 to document its integrity and to determine whether it is functioning as designed. The inspection must determine whether the pipe is intact, clear and fully functional. The permittee must submit a written report to DEQ regarding the results of the outfall inspection by the date in Table B1. The report must include a description of the outfall as originally constructed, the condition of the current outfall and identify any repairs needed to return the outfall to satisfactory condition.

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SCHEDULE E: PRETREATMENT ACTIVITIES

Lincoln City does not have a pretreatment program. The City is required to conduct an Industrial User Survey.

SCHEDULE F: NPDES GENERAL CONDITIONS

SECTION A. STANDARD CONDITIONS

A1. Duty to Comply with Permit

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

A2. Penalties for Water Pollution and Permit Condition Violations

The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions of 33 USC § 1365. DEQ enforcement is generally based on provisions of state statutes and Environmental Quality Commission (EQC) rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows DEQ to impose civil penalties up to \$25,000 per day for violation of a term, condition, or requirement of a permit.

Under ORS 468.943, unlawful water pollution in the second degree, is a Class A misdemeanor and is punishable by a fine of up to \$25,000, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense.

Under ORS 468.946, unlawful water pollution in the first degree is a Class B felony and is punishable by a fine of up to \$250,000, imprisonment for not more than 10 years, or both.

The Clean Water Act provides that any person who violates permit condition, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed \$25,000 per day for each violation.

The Clean Water Act provides that any person who negligently violates any condition, or any requirement imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of \$2,500 to \$25,000 per day of violation, or imprisonment of not more than 1 year, or both.

In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than \$50,000 per day of violation, or by imprisonment of not more than 2 years, or both.

Any person who knowingly violates such sections, or such conditions or limitations is subject to criminal penalties of \$5,000 to \$50,000 per day of violation, or imprisonment for not more than 3 years, or both.

In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than \$100,000 per day of violation, or imprisonment of not more than 6 years, or both.

Any person who knowingly violates section any permit condition, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than \$250,000 or imprisonment of not more than 15 years, or both.

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In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than \$500,000 or by imprisonment of not more than 30 years, or both.

An organization, as defined in section 309(c)(3)(B)(iii) of the CWA, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than \$1,000,000 and can be fined up to \$2,000,000 for second or subsequent convictions.

Any person may be assessed an administrative penalty by the Administrator for violating any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act.

Administrative penalties for Class I violations are not to exceed \$10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed \$25,000.

Penalties for Class II violations are not to exceed \$10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed \$125,000.

A3. Duty to Mitigate

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

A4. Duty to Reapply

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

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

A5. Permit Actions

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

- a. Violation of any term, condition, or requirement of this permit, a rule, or a statute.
- b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts.
- c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.
- d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a total maximum daily load (TMDL).
- e. New information or regulations.
- f. Modification of compliance schedules.
- g. Requirements of permit reopener conditions
- h. Correction of technical mistakes made in determining permit conditions.
- i. Determination that the permitted activity endangers human health or the environment.
- j. Other causes as specified in 40 CFR § 122.62, 122.64, and 124.5.
- k. For communities with combined sewer overflows (CSOs):
 - (1) To comply with any state or federal law regulation for CSOs that is adopted or promulgated subsequent to the effective date of this permit.
 - (2) If new information that was not available at the time of permit issuance indicates that CSO controls imposed under this permit have failed to ensure attainment of water quality standards, including protection of designated uses.

- (3) Resulting from implementation of the permittee's long-term control plan and/or permit conditions related to CSOs.

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

A6. Toxic Pollutants

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

A7. Property Rights and Other Legal Requirements

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

A8. Permit References

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

A9. Permit Fees

The permittee must pay the fees required by OAR.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

B1. Proper Operation and Maintenance

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

B2. Need to Halt or Reduce Activity Not a Defense

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

B3. Bypass of Treatment Facilities

- a. Definitions
- (1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b and c of this section.
 - (2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
- b. Prohibition of bypass.
- (1) Bypass is prohibited and DEQ may take enforcement action against a permittee for bypass unless:
 - i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
 - ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
 - iii. The permittee submitted notices and requests as required under General Condition B3.c.
 - (2) DEQ may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, if DEQ determines that it will meet the three conditions listed above in General Condition B3.b.(1).
- c. Notice and request for bypass.
- (1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to DEQ at least ten days before the date of the bypass.
 - (2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D5.

B4. Upset

- a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.
- b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
- c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
- (1) An upset occurred and that the permittee can identify the causes(s) of the upset;
 - (2) The permitted facility was at the time being properly operated;
 - (3) The permittee submitted notice of the upset as required in General Condition D5, hereof (24-hour notice); and
 - (4) The permittee complied with any remedial measures required under General Condition A3 hereof.
- d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

B5. Treatment of Single Operational Upset

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

B6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

- a. Definition. "Overflow" means any spill, release or diversion of sewage including:
 - (1) An overflow that results in a discharge to waters of the United States; and
 - (2) An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.
- b. Reporting required. All overflows must be reported orally to DEQ within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D5.

B7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (for example, public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B8. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

B8. Emergency Response and Public Notification Plan

The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses, or upsets that may endanger public health. At a minimum the plan must include mechanisms to:

- a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
- b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
- c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
- d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
- e. Provide emergency operations; and
- f. Ensure that DEQ is notified of the public notification steps taken.

B9. Removed Substances

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

SECTION C. MONITORING AND RECORDS

C1. Representative Sampling

Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and must be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points must not be changed without notification to and the approval of DEQ. Samples must be collected in accordance with requirements in 40 CFR Part 122.21 and 40 CFR Part 403 Appendix E.

C2. Flow Measurements

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

C3. Monitoring Procedures

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

For monitoring of recycled water with no discharge to waters of the state, monitoring must be conducted according to test procedures approved under 40 CFR 136 or as specified in the most recent edition of Standard Methods for the Examination of Water and Wastewater unless other test procedures have been specified in this permit or approved in writing by DEQ.

C4. Penalties for Tampering

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

C5. Reporting of Monitoring Results

Monitoring results must be summarized each month on a discharge monitoring report form approved by DEQ. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

C6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR Part 136 or, in the case of sludge (biosolids) use and disposal, approved under 40 CFR Part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the discharge monitoring report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (for example, total residual chlorine), only the average daily value must be recorded unless otherwise specified in this permit.

C7. Averaging of Measurements

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

C8. Retention of Records

Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities must be retained for a period of at least 5 years (or longer as required by 40 CFR Part 503). Records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit and records of all data used to complete the application for this permit must be retained for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of DEQ at any time.

C9. Records Contents

Records of monitoring information must include:

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

C10. Inspection and Entry

The permittee must allow DEQ or EPA upon the presentation of credentials to:

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

C11. Confidentiality of Information

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

SECTION D. REPORTING REQUIREMENTS

D1. Planned Changes

The permittee must comply with OAR 340-052, "Review of Plans and Specifications" and 40 CFR § 122.41(I)(1). Except where exempted under OAR 340-052, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by DEQ. The permittee must give notice to DEQ as soon as possible of any planned physical alternations or additions to the permitted facility.

D2. Anticipated Noncompliance

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

D3. Transfers

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

D4. Compliance Schedule

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

D5. Twenty-Four Hour Reporting

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

a. Overflows.

(1) Oral Reporting within 24 hours.

- i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to the DEQ regional office.
 - (a) The location of the overflow;
 - (b) The receiving water (if there is one);
 - (c) An estimate of the volume of the overflow;
 - (d) A description of the sewer system component from which the release occurred (for example, manhole, constructed overflow pipe, crack in pipe); and
 - (e) The estimated date and time when the overflow began and stopped or will be stopped.
- ii. The following information must be reported to the DEQ regional office within 24 hours, or during normal business hours, whichever is earlier:
 - (a) The OERS incident number (if applicable); and
 - (b) A brief description of the event.

(2) Written reporting postmarked within 5 days.

- i. The following information must be provided in writing to the DEQ regional office within 5 days of the time the permittee becomes aware of the overflow:
 - (a) The OERS incident number (if applicable);
 - (b) The cause or suspected cause of the overflow;
 - (c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
 - (d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
 - (e) For storm-related overflows, the rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

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

b. Other instances of noncompliance.

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

- i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
- ii. Any upset that exceeds any effluent limitation in this permit;

- iii. Violation of maximum daily discharge limitation for any of the pollutants listed by DEQ in this permit; and
- iv. Any noncompliance that may endanger human health or the environment.
- (2) During normal business hours, the DEQ regional office must be called. Outside of normal business hours, DEQ must be contacted at 1-800-452-0311 (Oregon Emergency Response System).
- (3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:
 - i. A description of the noncompliance and its cause;
 - ii. The period of noncompliance, including exact dates and times;
 - iii. The estimated time noncompliance is expected to continue if it has not been corrected;
 - iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
 - v. Public notification steps taken, pursuant to General Condition B7.
- (4) DEQ may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

D6. Other Noncompliance

The permittee must report all instances of noncompliance not reported under General Condition D4 or D5 at the time monitoring reports are submitted. The reports must contain:

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

D7. Duty to Provide Information

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

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

D8. Signatory Requirements

All applications, reports or information submitted to DEQ must be signed and certified in accordance with 40 CFR § 122.22.

D9. Falsification of Information

Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed \$125,000 per violation and up to 5 years in prison per ORS chapter 161. Additionally, according to 40 CFR § 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance will, upon conviction, be punished by a federal civil penalty not to exceed \$10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

D10. Changes to Indirect Dischargers

The permittee must provide adequate notice to DEQ of the following:

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

SECTION E. DEFINITIONS

- E1. *BOD* or *BOD₅* means five-day biochemical oxygen demand.
- E2. *CBOD* or *CBOD₅* means five-day carbonaceous biochemical oxygen demand.
- E3. *TSS* means total suspended solids.
- E4. *Bacteria* means but is not limited to fecal coliform bacteria, total coliform bacteria, *Escherichia coli* (*E. coli*) bacteria, and *Enterococcus* bacteria.
- E5. *FC* means fecal coliform bacteria.
- E6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
- E7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR § 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-041.
- E8. *mg/l* means milligrams per liter.
- E9. *µg/l* means microgram per liter.
- E10. *kg* means kilograms.
- E11. *m³/d* means cubic meters per day.
- E12. *MGD* means million gallons per day.
- E13. *Average monthly effluent limitation* as defined at 40 CFR § 122.2 means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.
- E14. *Average weekly effluent limitation* as defined at 40 CFR § 122.2 means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.
- E15. *Daily discharge* as defined at 40 CFR § 122.2 means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge must be calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge must be calculated as the average measurement of the pollutant over the day.
- E16. *24-hour composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow.
- E17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
- E18. *Quarter* means January through March, April through June, July through September, or October through December.
- E19. *Month* means calendar month.
- E20. *Week* means a calendar week of Sunday through Saturday.
- E21. *POTW* means a publicly-owned treatment works.



National Pollutant Discharge Elimination System Permit Renewal Evaluation Report

Oregon Department of Environmental Quality
Western Region Office
4026 Fairview Industrial Dr. SE
Salem OR 97302

Contact: Robert Dicksa, 503-378-5039

Permittee:	City of Lincoln City PO Box 50 Lincoln City, OR 97367
Existing Permit Information:	File Number: 50677 Permit Number: 101122 Expiration Date: 1/2/31/2007 EPA Reference Number: OR0020478
Source Contact:	Daniel Christian, (541) 921-9658 Wastewater Treatment Plant Supervisor
Site Location :	5000 SE Port Lincoln City, OR 97367 Lincoln County
LLID: NHD:	1240202449262 RM 1.1 17100204000208 - 22.28%
Receiving Stream/Basin:	Schooner Creek WRD Basin: Mid Coast USGS Subbasin: Siletz/Yaquina
Proposed Action:	Renew Permit Application Number: 974306 Date Received: June 29, 2007
Source Category:	NPDES Major– Domestic
Sources Covered:	Domestic Wastewater
Permit Type:	NPDES Domestic C2a
Permit Writer:	Robert Dicksa Senior Permit Writer, Western Region, Salem 10/26/2017

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1. Introduction

The Department of Environmental Quality (DEQ) proposes to renew the National Pollutant Discharge Elimination System (NPDES) wastewater permit for the City of Lincoln City located at 5000 SE Port, Lincoln City, OR 97367. This permit allows and regulates the discharge of treated wastewater effluent to Schooner Creek at River Mile 1.1. The permit also allows the City of Lincoln City to beneficially reuse recycled water.

The purpose of this permit evaluation report is to explain and provide justification for the permit.

The Federal Water Pollution Control Act of 1972 (also known as the Clean Water Act) and its subsequent amendments, as well as Oregon Revised Statutes (ORS 468B.050), require a NPDES permit for the discharge of wastewater to surface waters. This proposed permit action by DEQ complies with both federal and state requirements.

2. Permit History

2.1 Issuance, Renewal and Modifications

The existing NPDES Permit expired on December 31, 2007. DEQ received renewal application number 974306 from the City of Lincoln City on June 29, 2007. Because the permittee submitted a renewal application to DEQ in a timely manner, the existing permit will not expire until DEQ takes final action on the renewal application as per OAR 340-045-0040. The existing permit was issued in 2003 to the permittee for the existing activated sludge treatment facility. The City upgraded to a Sequencing Batch Reactor activated sludge facility in 2009. A permit renewal was not completed for the upgraded facility therefore; this permit renewal is being proposed for the upgraded facility.

2.2 Compliance History

The facility was last inspected on August 4, 2016 and was found to be operating in compliance with the permit. The following violations have been documented since 2007:

Date of Enforcement Action	Type of Violation	Description
February 24, 2011	Class I	Warning Letter for a Sanitary Sewer Overflow from collection system but was beyond reasonable control of the permittee.
February 22, 2011	Class III	Warning Letter for violating a technology based effluent limit by 1 pH unit or less.
June 9, 2009	Class I	Warning Letter for failure to submit engineering plans prior to construction.
August 21, 2008	Class II	Warning Letter for violating a technology based effluent limit if the discharge exceeds the bacteria limit by more than five times the limit.
February 14, 2008	Class III	Violating a technology based effluent limit by 1 pH unit or less.

These violations have been corrected through better operation and maintenance at the facility. DEQ considers the facility in compliance with the terms of the permit.

3. Proposed Revisions

The proposed permit contains the following substantive changes from the 2002 permit:

- Schedule A – The proposed renewal permit updates this schedule to reflect the latest language in the most recent version of the permit template, including additional language regarding biosolids. This schedule retains discharge limits from the previous permit, and includes a new discharge limit for Total Recoverable Copper, Total Recoverable Zinc, bacteria and temperature. The previous permit listed 29 emergency overflow Outfalls 002-030. DEQ's bacteria rule OAR 340-041-0009, prohibits discharges of raw sewage. Therefore, these emergency overflow outfalls have been removed from the proposed NPDES permit. The previous permit listed three Reclaimed Water Outfalls in accordance with the old OAR Division 55 rules. These outfalls have been combined and listed as Outfall 002 for recycled water in the proposed NPDES permit in accordance with the current OAR Division 55 rules.
- Schedule B – The proposed renewal permit updates this schedule to reflect the latest language in the most recent version of the permit template, including additional language regarding monthly reporting using paper and electronic submission records.
- Schedule C – The proposed renewal permit updates this schedule to reflect the latest language in the most recent version of the permit template, and contains a compliance schedule to meet the new limits for copper, zinc, bacteria, and temperature.
- Schedule D – The proposed renewal permit updates this schedule to reflect the latest language in the most recent version of the permit template, including additional language regarding inflow and infiltration, emergency response and public notification, land application and wastewater solids transfer, hauled waste control, and industrial user survey.
- Schedule E – The proposed renewal permit does not have a Schedule E.

4. Facility Description

4.1 Wastewater Facilities Description

The City of Lincoln City sewage treatment plant is a Sequencing Batch Reactor activated sludge plant located at the south end of town (See Figure 1). The facilities include a headworks, a four-basin SBR, recycle pump station, effluent filters, ultraviolet disinfection, aerobic sludge digestion, sludge thickening, two sludge storage lagoons and an emergency overflow pond. The SBRs came online in 2009 and effluent filters were added and came online in 2012. In addition, a constant feed magnesium hydroxide unit for maintaining alkalinity was brought online in 2012. The magnesium hydroxide is stored in a 4000-gallon tank and is added right at the headwork's just after grit removal. The four SBR basins each hold 1.1 million gallons and are designed to treat 0.75 MGD. Standard operation is to have one basin always in fill mode, two in react mode,

and one in decant mode. However, the effluent flow is not always constant and there may be periods during the decant process when there is no flow, especially during low flow months. The facility does not have a flow equalization basin prior to the two effluent filter trains and two UV disinfection channels. No chlorine is used in the plant process water. The facility also has an internal pump station. This pump station receives flow from backwashing the filters, septage receiving station, thickener filtrate, and digester decant water and all plant internal sewers. The water is pumped and returned to the influent at the headworks prior to the screens. The sludge storage lagoons have a separate pump station that directs any lagoon decant water directly to the headworks.

Figure 1: Lincoln City Wastewater Facility



4.2 Outfalls

The existing permit has one permitted outfall (001), which allows the discharge of treated wastewater into Schooner Creek at River Mile 1.1, (Latitude 44.93274, Longitude -124.00561). The outfall is a 36-inch diameter, ductile iron open pipe that extends approximately three feet into the creek. The outfall pipe is not equipped with a diffuser although a 1994 mixing zone study recommended one to improve mixing and dilution. Three recycled water outfalls, 102, 103, and 104, allow the beneficial reuse of wastewater under the previous Division 55, rules for Level II, III, and IV reclaimed wastewater. The proposed permit will consolidate the three recycled

water outfalls into a single Outfall 002 that allows the beneficial reuse of recycled water under the current Division 55 rules for Class A, Class B, and Class C recycled wastewater. The city will not be allowed to land apply recycled wastewater through this outfall until they have an approved Recycled Water Use Plan from DEQ. The existing permit lists emergency overflow Outfalls 002-030, for sanitary sewer overflows. Sanitary sewer overflows are not allowed under a NPDES permit. Therefore, the emergency overflow outfalls will not be permitted in the proposed permit.

4.3 Sewage Collection System

Sewage collection systems are designed to collect and transport raw sewage from residences and businesses to the municipality's wastewater treatment facility. As collection systems age, the pipes develop cracks, allowing the infiltration of groundwater. Stormwater may also enter the system. Though no longer allowed under current plumbing codes, in the past it was common to connect stormwater drains directly to sewers. The entry of groundwater and stormwater into the collection system is known as infiltration and inflow, or I/I for short.

When a collections system experiences excessive I/I, most of the flow that makes it to the treatment plant may in fact be stormwater or groundwater that by itself does not require treatment. This can result in the following:

- Overflows from the sanitary sewer system when it rains. These are referred to as SSOs (sanitary sewer overflows).
- The release of untreated or partially treated sewage from all or a portion of the treatment plant. Such a release is termed a bypass. Bypasses may be necessary to avoid damaging the plant.
- Increased operation and maintenance costs.

The ratio of the average maximum month wet weather flow to the average dry weather flow measured at the treatment plant is an indication of how much I/I may be occurring in the collection system. The facility data was evaluated for the last three years. The average dry weather flow during the summer period into the wastewater facility was 1.503 MGD. Average maximum month wet weather flow into the wastewater facility was 6.9 MGD and occurred in December 2015. The ratio of winter average maximum month flow to the summer average dry weather flow equals a peaking factor of 4.59. In western Oregon, a peaking factor of 3 or higher is an indication that a facility is experiencing I/I and should have an ongoing collection system maintenance program to keep up with I/I in the system.

DEQ recognizes that it is not practical to attempt to build and operate treatment plants and collection systems to eliminate any and all bypasses or overflows, and that at some point, attempts to do so represent a poor investment of public funds. Therefore, DEQ is interested in encouraging communities to reduce the rate at which SSOs and bypasses occur. To this end, the proposed permit requires the permittee to continue to do following:

- The municipality must continue its program to reduce I/I and submit a progress reports on an annual basis (see Schedule D, Condition 1).

- The municipality must update and maintain the emergency response and public notification plan to cover bypass and SSO events (Schedule F, sections B.7 and B.8)

The municipality must report all SSOs and bypasses (Schedule F, sections B.6, B.7 and B.8).

4.4 Recycled Water

The permittee does not currently have a DEQ approved Recycled Water Use Plan. The existing permit has Outfalls 102, 103, and 104 listed for the beneficial reuse of wastewater in accordance with the previous Division 55 rules for land application of Level II, III, and IV, reclaimed wastewater. The proposed permit will consolidate the three outfalls into a single Outfall 002, and contain limits for the beneficial reuse of recycled wastewater under the current Division 55 rules for Class A, Class B, and Class C recycled wastewater. The limits for Class A, Class B, and Class C recycled water are:

- Class A: Prior to the disinfection of the recycled water, the turbidity must not exceed an average of 2 nephelometric turbidity units (NTUs) within a 24-hour period, 5 NTUs more than five percent of the time within a 24-hour period, and 10 NTUs at any time. After disinfection, the total coliform bacteria must not exceed a median of 2.2 organisms per 100 mL based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 mL in any single sample.
- Class B: Must be oxidized and disinfected and must not exceed a median of 2.2 total coliform organisms per 100 mL, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 mL in any single sample.
- Class C: Must be oxidized and disinfected and must not exceed a median of 23 total coliform organisms per 100 mL, based on results of the last seven days that analyses have been completed, and 240 total coliform organisms per 100 mL in any two consecutive samples.

The permittee will be required to state the selected land application area and class of recycled water in the Recycled Water Use Plan. Following DEQ approval, the land application of the wastewater must conform to the DEQ-approved plan.

Prior to the distribution of any recycled water, a Recycled Water Use Plan must be submitted to DEQ for review and approval. All recycled water must be managed in accordance with the requirements of the proposed permit, the recycled water use rules (OAR 340-055), and the approved Recycled Water Use Plan. Specific locations, crops, application rates, buffers and approved uses in accordance with OAR 340-055, are approved by DEQ with the Recycled Water Use Plan. Upon DEQ approval of the Recycled Water Use Plan, the Plan shall become enforceable through the proposed NPDES permit.

4.5 Wastewater Solids

The purpose of this section is to describe and document how wastewater solids are handled in the treatment plant. The term wastewater solid includes sewage sludge and biosolids. Sewage sludge refers to solids from primary, secondary, or advanced treatment of domestic wastewater that have not been treated or determined to be suitable for land application as fertilizer or soil amendment. The term biosolids refers to domestic wastewater treatment facility solids that have undergone adequate treatment and are suitable for application to the land as a fertilizer or soil amendment.

4.5.1 Storage of Sewage Sludge

The WWTP has two digesters into which it transfers waste sludge from the SBR. The digesters are equipped with mixers and aeration racks that provide the oxygen necessary for the aerobic digestion process. The digesters are periodically shut off, allowing the liquid and sludge to separate. The clear supernatant is decanted back to the SBR for treatment leaving the thickened sludge. Digested sludge is pumped to two lagoons for further anoxic treatment and subsequent land application on DEQ approved land application sites. Liquid from rainwater and passive dewater of the sludge is removed from the lagoons by a telescoping overflow valve and returned to the SBR for treatment. The City generated Class B biosolids for land application until August 2016. They discontinued land application of treated biosolids on their approved sites because of too much nitrogen on the application sites. Since 2016, the City has been using a dewatering centrifuge and hauling the solids to Coffin Butte landfill.

The City recently updated their Biosolids Management Plan and submitted to DEQ for approval in September 2019. The updated plan continues the current sludge landfill process, but includes the option to generate Class B biosolids for land application as a back up to the landfill process. The updated BMP will be available for review as part of the proposed permit public notice process.

4.5.2 Land Application

In 2014, the City pumped approximately 263 dry tons to the sludge holding lagoons. The City properly land applied approximately 148 dry tons of biosolids. The biosolids met the Class B pathogen and vector attraction (volatile solids reduction) requirements in 40 CFR part 503. As long as the biosolids are used beneficially as soil amendment at agronomic rates, biosolids management is regulated under OAR Chapter 340, Division 50. In accordance with this rule, each permitted source must submit a biosolids management plan. A biosolids management plan was submitted to DEQ and approved on October 17, 2003. As stated above, the City of Lincoln City is temporarily hauling the biosolids to Coffin Butte Landfill for disposal. The proposed permit will contain a condition in Schedule D that requires the City of Lincoln City to submit an updated biosolids management plan developed in accordance with OAR 340, Division 50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage" six (6) months prior to any change in the current practice of biosolids management. Upon approval of the plan by DEQ, the plan must be implemented by the permittee.

4.6 Stormwater

NPDES general permits for stormwater are required for wastewater treatment facilities with a design flow of greater than 1 MGD when stormwater is collected and discharged from the plant site. Stormwater from this site is regulated under a General 1200Z NPDES Permit assigned to this facility.

4.7 Groundwater

The previous treatment plant had several earthen basin structures that leaked excessively, indicating potential groundwater impacts. The upgrades to the treatment facility that the City completed and brought online in 2009 eliminated these structures and the potential impacts to groundwater.

Based on DEQ's current information, this facility has a low potential for adversely impacting groundwater quality. All wastewater and process related residuals must be managed and disposed of in a manner that will prevent any violation of the DEQ's groundwater quality protection rules (OAR 340-040). Schedule A of the proposed permit includes a condition prohibiting adverse impacts to groundwater.

4.8 Industrial Pretreatment

Municipalities that receive wastewater from certain categories of industries must have approved pretreatment programs in place. These programs are designed to reduce the discharge of pollutants from identified industries that the treatment plant is not able to treat. These pollutants can interfere with treatment plant operation, reduce the value of wastewater and biosolids for reuse, cause worker health or safety concerns, and pose a risk to the public or the environment.

Lincoln City conducted an Industrial User Survey during the last permit cycle and determined that a DEQ-approved industrial pretreatment program is not needed. No categorical industrial users were identified in the IU survey update submitted with the city's permit renewal application. Schedule D Condition 11, of the proposed permit requires the permittee to conduct and submit to DEQ an updated Industrial Waste Survey (Survey) within 24 months of the permit effective date. DEQ will review the Survey results and, if DEQ determines that a pretreatment program is required, the permit may be reopened and modified to require development of a pretreatment program.

5. Receiving Water

The City of Lincoln City discharges to Schooner Creek at river mile (RM) 1.1. The designated beneficial uses of Schooner Creek at this location are as follows:

- Public and private domestic water supply
- Industrial water supply
- Irrigation
- Livestock watering
- Fish and Aquatic Life

- Wildlife Hunting
- Fishing
- Boating
- Water Contact Recreation
- Aesthetic Quality and
- Hydro Power

The water quality standards for the Mid Coast Basin were developed to protect these beneficial uses and can be found in Oregon Administrative Rules 340-041-0220.

5.1 Receiving Stream Water Quality

At the point of discharge, Schooner Creek is included on DEQ's List of Water Quality Limited Water Bodies (also called the 303(d) Lists) as water quality limited for *E. coli* bacteria during the summer and temperature year round for salmonid rearing.

The NPDES permit represents the Bacteria Control Management Plan for the City of Lincoln City. As long as the discharge remains in compliance with the permit's bacteria limits, the treated effluent discharge will not have a negative impact on the water quality of the Schooner Creek with respect to bacteria.

The existing permit contains an excess thermal load limit that shall not exceed 31 million Kcals/day during May 1 through October 31. The excess thermal load limit was calculated using the average dry weather design flow and an estimated maximum weekly effluent temperature. The permittee has been collecting temperature data since the existing permit was issued. This data will be used to calculate a new excess thermal load limit. If the new limit is more stringent than the existing permit limit, it will be replaced in the proposed permit.

5.2 Mixing Zone Analysis

Permits issued by DEQ sometimes specify mixing zones. Also known as, "allocated impact zones" or "regulatory mixing zones", mixing zones are allowed under both state and federal regulation. They are areas near outfalls in which all or some of Oregon's water quality standards can be suspended. DEQ allows mixing zones when the overall impact, evaluated with respect to Oregon's Mixing Zone Rule (OAR 340-041-0053) appears to be negligible.

Two mixing zones can be developed for each discharge: 1) The acute mixing zone, also known as the "zone of initial dilution" (ZID), and 2) the chronic mixing zone, usually referred to as "the mixing zone." The ZID is a small area where acute criteria can be exceeded as long as it does not cause acute toxicity to organisms drifting through it. The mixing zone is an area where acute criteria must be met but chronic criteria can be exceeded. It must be designed to protect the integrity of the entire water body.

The existing permit for the treatment facility contains the following language that allows the defined mixing zone:

The allowable mixing zone is that portion of Schooner Creek within a band extending out twenty (20) feet from the point of discharge and extending two hundred (200) feet upstream and downstream from the point of discharge. The Zone of Immediate Dilution (ZID) must be defined as that portion of the allowable mixing zone that is within twenty (20) feet of the point of discharge.

The City conducted a Level 2 Mixing Study during September 2016, and submitted a report to DEQ for review on December 30, 2016. The discharge and receiving water data were used as inputs to the CORMIX mixing zone model used to estimate dilutions at the edge of the regulatory mixing zone for acute, chronic and human health conditions. The CORMIX model estimated the following dilution factors:

ZID (Acute)	1
Mixing Zone (Chronic)	4
Mixing Zone (Human Health)	4

The human health mixing zone dilution is conservative because the evaluation was based on summer low flows rather than annual average flows. These dilutions were used in all reasonable potential evaluations and to determine permit limits in the proposed permit.

Results of the study indicate the plume extends out to the middle of the stream channel beyond the 20-foot lateral boundary. DEQ is proposing to remove this lateral boundary so the mixing zone matches field observations.

6. Overview of Permit Development

6.1 Types of Permit Limits

Effluent limitations serve as the primary mechanism in NPDES permits for controlling discharges of pollutants to receiving waters. Effluent limitations can be based on either the technology available to control the pollutants or limits that are protective of the water quality standards for the receiving water. These two types of permit limits are referred to as technology-based effluent limitations (TBELs) and water quality-based effluent limits (WQBELs) respectively. When a TBEL is not restrictive enough to protect the receiving stream, a WQBEL must be placed in the permit. More explanation of each is provided below.

- TBELs:
 - The intent of TBELs is to require a minimum level of treatment of pollutants based on available treatment technologies, while allowing the discharger to use any available control technique to meet the limits.

- TBELs for municipal treatment plants, also known as federal secondary treatment standards have been developed for the following parameters: biochemical oxygen demand measured over 5 days (BOD5), total suspended solids (TSS) and pH. These are found in the Code of Federal of Federal Regulations (CFR) and are known as secondary treatment standards. The CFR also allows special considerations and exceptions to these standards for certain circumstances and types of treatment facilities such as lagoons.
- WQBELs:
 - The intent of WQBELs is to ensure the water quality standards of a receiving stream are met. The water quality standards are developed to protect the beneficial uses of the receiving stream such as swimming and fishing. In many cases, TBELs are not restrictive enough to ensure the receiving stream meets water quality standards. In these cases, WQBELs need to be established to protect the receiving stream.
 - Oregon is unique in that it has minimum design criteria for BOD and TSS that are only applicable to sewage treatment plants. These design criteria vary by watershed basin and were developed to protect water quality in their respective basins. These are often times more stringent than the federal secondary treatment standards. When this is the case, the basin standards supersede the federal standards.

TBELs are likely to be the most stringent if the receiving stream is large relative to the discharge, and WQBELs are likely to be the most stringent when the receiving stream is small or does not meet water quality standards. In some cases, both a TBEL and a WQBEL will be developed for a particular parameter. Permit writers must include the more stringent of the two in the permit.

Permit limits for bacteria are WQBELs when they are derived from the water quality standards found in OAR 340-041-0009 for freshwater, marine, and estuarine waters or 40 CFR § 131.41 for coastal recreation waters. Bacteria limits are designed to protect human health when swimming or eating shellfish. Note: When enforcing permit limits, the department categorizes bacteria exceedances in OAR 340-012 as technology-based effluent limitation violations because bacteria violations are typically due to the failure of disinfection equipment.

Each time a permit is renewed, the permit writer evaluates the existing limits to see if they need to be modified as a result of changes to technology based standards or water quality standards that may have occurred during the permit term. Antibacksliding provisions (described in CFR 122.44(l)) generally do not allow relaxation of effluent limits in renewed/reissued permits. The more stringent of the existing or new limits must be included in the renewal permit.

6.2 Existing Permit Limits

The existing permit limits are as follows:

a. Treated Effluent Outfall 001

(1) May 1 - October 31:

Parameter	Average Effluent Concentrations		Monthly* Average lbs/day	Weekly* Average lbs/day	Daily* Maximum lbs
	Monthly	Weekly			
BOD ₅	10 mg/L	15 mg/L	250	380	500
TSS	10 mg/L	15 mg/L	250	380	500

(2) November 1 - April 30:

Parameter	Average Effluent Concentrations		Monthly* Average lbs/day	Weekly* Average lbs/day	Daily* Maximum lbs
	Monthly	Weekly			
BOD ₅	20 mg/L	30 mg/L	750	1100	1500
TSS	20 mg/L	30 mg/L	750	1100	1500

*Average dry weather design flow to the facility equals 3.0 MGD. Summer mass load limits based upon average dry weather design flow to the facility. Winter mass load limits based upon average wet weather design flow to the facility equaling 4.5 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 6 MGD (twice the design average dry weather flow).

(3)

Other parameters (year-round)	Limitations
Fecal Coliform Bacteria	Must not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL. (See Notes 1 and 2)
pH	Must be within the range of 6.0 - 9.0
BOD ₅ and TSS Removal Efficiency	Must not be less than 85% monthly average for BOD ₅ and TSS.
Total Residual Chlorine	Must not exceed a daily maximum concentration of 0.02 mg/L.
Excess Thermal Load (May 1 – Oct 31)	Must not exceed a weekly average of 31 million Kcals/day (see Note 3)
<p>Note 1: This permit may be reopened and modified as necessary to incorporate any Waste Load Allocation (WLA) or Best Management Practice established by the TMDL for bacteria for this sub-basin.</p> <p>Note 2: If a single sample exceeds 406 organisms per 100 mL, five consecutive re-samples may be taken at intervals between two and four hours beginning with 28 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation shall not be triggered.</p>	

Note 3: The excess thermal load limit was calculated using the average dry weather design flow and an estimated maximum weekly effluent temperature. This permit may be re-opened, and the maximum allowable thermal load modified, when more accurate effluent temperature and/or flow data becomes available. In addition, if the Total Maximum Daily Load (TMDL) for temperature for this sub-basin assigns a Waste Load Allocation (WLA) to this source, this permit may be re-opened to establish new thermal load limits and/or new temperature conditions or requirements.

6.3 Overview of Whole Effluent Toxicity Analysis

Once the permit writer has determined the appropriate TBEL or QBEL permit limits (described in the previous section) for the facility, the permit writer must determine whether there is reasonable potential for the discharge to cause toxicity due to combinations of chemicals that may be present in the effluent. This is done via Whole Effluent Toxicity (WET) testing. WET testing involves controlled laboratory experiments in which aquatic organisms are exposed to samples of effluent at different dilutions. EPA recommends running WET tests using an invertebrate, vertebrate, and a plant test organism, and has developed WET test protocols using freshwater, marine, and estuarine test species that measure both acute and chronic effects. Depending on the test, the measured effect may be fertilization, growth, reproduction, or survival.

For facilities that have mixing zones, an acute WET test is considered to show toxicity if significant mortality occurs at effluent concentrations less than that which is found at the edge of the zone of immediate dilution (ZID). A chronic WET test is considered to show toxicity if significant adverse effects occur at effluent concentration less than that which is known to occur at the edge of the mixing zone. If the facility does not have a mixing zone, the tests are conducted using 100% effluent.

The permit holder must submit the results of WET tests as part of the permit application process. If the permit writer determines, based on the results of these tests that there is a potential for the effluent to cause toxicity in the receiving stream, the permit writer will include WET test requirements in the Special Conditions section of the permit. These conditions in the permit will describe follow up requirements in the event that the WET tests indicate toxicity.

6.3.1 Whole Effluent Toxicity Analysis for the City of Lincoln City

The City of Lincoln City conducted WET tests in 2007, as required by the existing permit. The treatment plant that produced the samples no longer exists and those WET test results do not characterize the effluent produced by the current WWTP.

DEQ is requiring WET testing in Schedule B of the proposed renewal permit. If acute and chronic effects are reported by the testing, DEQ will re-open the permit and include new limits, monitoring requirements, and/or conditions as determined by DEQ to be appropriate as required by Schedule D, Condition 8.

6.4 Biosolids

Biosolids may be used as a soil amendment and fertilizer on agricultural land. For this beneficial use to be allowed, wastewater solids must meet federal criteria for pathogen reduction (Class A or Class B biosolids), vector attraction reduction for sludge stability, nutrients and pollutant concentrations (40 CFR Part 503).

6.4.1 Biosolids Production

In 2014, the City pumped approximately 263 dry tons to the sludge holding lagoons. The City properly land applied approximately 148 dry tons of biosolids on DEQ approved sites.

6.4.2 Beneficial Reuse of Biosolids

OAR 340-050-0031 requires facilities that reuse biosolids through land application to maintain a biosolids management plan and land application plan. The biosolids management plan describes how the facility will generate biosolids that are suitable for beneficial use as a fertilizer or soil amendment via land application. The land application plan identifies and describes the management of current and potential biosolids land application sites. Conditions in the biosolids management plan and land application plan are enforceable permit conditions. Since August 2016, the City has not been able to land apply treated biosolids on their approved sites because of too much nitrogen and has had to put the solids in the sludge holding lagoons. From January 1, 2017 through August 2017, the City put approximately 124.8 dry tons of biosolids in the sludge holding lagoons. On August 10, 2017, the City brought on-line a temporary sludge-dewatering centrifuge. As of spring 2019, the City has been accepting sludge from the City of Depoe Bay and is now dewatering and hauling all of the solids to Coffin Butte landfill. An updated Biosolids Management Plan was approved by DEQ in September 2019. The updated plan details the current sludge landfill process, as well as the option to generate Class B biosolids for land application on approved sites as a back up to the landfill process. The updated plan will be included for review in the proposed permit public notice process.

6.5 Antidegradation

DEQ must demonstrate that the discharge does not lower water quality from the existing condition. DEQ is required to make this demonstration is required under Oregon's Antidegradation Policy for Surface Waters found in OAR 340-041-0004. DEQ has performed an antidegradation review for this discharge. The proposed permit contains the same discharge loadings as the existing permit. Permit renewals with the same discharge loadings as the previous permit are not considered to lower water quality from the existing condition. DEQ is not aware of any information that existing limits are not protective of the designated beneficial uses. These uses are very broad and include fish and aquatic life (including cold water species, salmonid migration, spawning and rearing), fishing, boating, and water contact recreation. DEQ is also not aware of any existing uses present within the waterbody that are not currently protected by standards developed to protect the designated uses. Therefore, DEQ has determined that the proposed discharge complies with DEQ's antidegradation policy (See Antidegradation Review Worksheet, Attachment 1).

7. Permit Draft Discussion

7.1 Face Page

The face page provides information about the permittee, description of the wastewater, outfall locations, receiving stream information, permit approval authority, and a description of permitted activities. The permit allows discharge to Schooner Creek at river mile 1.1, within limits set by Schedule A and the following schedules. It prohibits all other discharges.

In accordance with state and federal law, NPDES permits will be effective for a fixed term not to exceed 5 years. Upon issuance, this permit will be effective for no more than 5 years.

DEQ evaluated the classifications for the treatment and collection systems (See Attachment 2). The treatment system is a Class IV system and the collection system is a Class III system. DEQ is not proposing any changes to the system classifications.

7.2 Permit Limit Derivation

7.2.1 Technology-Based Effluent Limits

TBELs must be met at the outfall. The applicable TBELs for this facility are the most stringent of the federal secondary treatment standards and the Oregon basin standards, adjusted as necessary for the type of treatment system.

The table below shows a comparison of the federal secondary treatment standards and Oregon basin standards and lists bacteria standards. Basin standards and bacteria standards are not strictly speaking TBELs; however, they function as such when they have to be met at the end of the pipe.

Table 1: Comparison of Federal Secondary Treatment and Basin Standards

Parameter	Federal Secondary Treatment Standards		Mid Coast Basin Standards (OAR 340-041-0225)
	30-Day Average	7-Day Average	30-Day Average
5-Day BOD	30 mg/L	45 mg/L	20 mg/L during May-Oct period, and a minimum of secondary treatment during Nov-Apr period.
TSS	30 mg/L	45 mg/L	
pH	6.0 – 9.0. (instantaneous)		6.5-8.5 standard units Note: Basin standards for pH do not have to be met at the outfall and can instead be met at the edge of the mixing zone.
% Removal	85% BOD5 and TSS		Not specified

Based on the Mid Coast Basin minimum design criteria, wastewater treatment resulting in a monthly average effluent concentration of 20 mg/L for BOD₅ and TSS must be provided from May 1- October 31. From November 1 – April 30, a minimum of secondary treatment or equivalent control is required. Secondary treatment for this facility is defined as monthly average concentration limit of 30 mg/L for BOD₅ and TSS.

The following equation is used to develop the monthly average mass load:

$$\text{Monthly Avg. Mass Load} = \text{POTW design flow} \times \text{Conc.-based limit} \times \text{Conversion factor}$$

The weekly average and maximum daily mass loads are developed from the monthly average by multiplying by 1.5 and 2 respectively.

The existing NPDES permit mass load limits were based on what the previous treatment facility was capable of achieving and the average dry weather design flow during the summer and the average wet weather design flow in the winter. The summer mass load limits for BOD₅ and TSS were based on the design flow of 3.0 MGD and a concentration of 10 mg/L. The winter mass load limits for BOD₅ and TSS were based on the design flow of 4.5 MGD and a concentration of 20 mg/L. All mass load limitations are rounded to two significant figures, consistent with the number of significant figures associated with flow measurements with this facility, and with the accuracy of BOD measurements of 10 or greater.

The upgraded SBR treatment facility has a design average dry weather flow of 2.1 MGD and the same design average wet weather flow of 4.5 MGD. The summer mass load limits for BOD₅ and TSS are based on the design flow of 2.1 MGD and the Mid-Coast Basin concentration of 20 mg/L. The following calculations for the summer season are:

$$\text{Monthly Average: } 2.1 \text{ MGD} \times 20 \text{ mg/L} \times 8.34 = 350 \text{ lbs/day}$$

$$\text{Weekly Average: } 350 \text{ lbs/day} \times 1.5 = 525 \text{ lbs/day rounded to } 530 \text{ lbs/day}$$

$$\text{Daily Maximum: } 350 \text{ lbs/day monthly} \times 2 = 700 \text{ lbs/day}$$

On any day that the daily flow exceeds twice the design average dry weather flow, the daily mass load limits shall not apply.

The winter mass load limits for BOD₅ and TSS are based on the design flow of 4.5 MGD and the Federal Secondary Standard concentration of 30 mg/L. The following calculations for the winter season are:

$$\text{Monthly Average: } 4.5 \text{ MGD} \times 30 \text{ mg/L} \times 8.34 = 1126 \text{ lbs/day rounded to } 1100 \text{ lbs/day}$$

$$\text{Weekly Average: } 1100 \text{ lbs/day} \times 1.5 = 1688 \text{ lbs/day rounded to } 1700 \text{ lbs/day}$$

$$\text{Daily Maximum: } 1100 \text{ lbs/day monthly} \times 2 = 2200 \text{ lbs/day}$$

The increased mass load limits calculated above based on the upgraded facility design flows, the basin standards in summer, and the federal standards in winter are less restrictive than the previous permit. In order to approve and permit a discharge at these higher mass load limits, DEQ and the permittee are obligated to meet the requirements to satisfy antidegradation in accordance with OAR 340-041-0004(9), and Anti-backsliding in accordance with 40 CFR § 122.44(I).

The City of Lincoln City does not want to make the request for a mass load increase at this time. Therefore, DEQ is proposing to retain the City of Lincoln City's summer and winter mass load limits for BOD₅ and TSS in the existing permit, which are more restrictive than the basin standard and the federal secondary treatment standards.

7.2.2 Water Quality-Based Effluent Limits

Once TBELs and applicable basin standards have been established for the treatment facility, WQBELs must be developed. DEQ has developed several tools for calculating WQBELs. The use of the reasonable potential analysis for the applicable pollutants is described below.

7.2.2.1 General Discussion of Reasonable Potential Analysis

EPA has developed a methodology called Reasonable Potential Analysis (RPA) for determining if there is a reasonable potential for a discharge to cause or contribute to violations of water quality standards for a particular parameter. It takes into account effluent variability, available dilution (if applicable), receiving stream water quality and water quality standards for the protection of aquatic life and human health. If the RPA results indicate that there is a potential for the discharge to cause or contribute to exceedances of water quality standards, the methodology is used to establish permit limits that will not cause or contribute to violations of water quality standards.

DEQ has adopted EPA's methodology for RPA, and has developed spreadsheets that incorporate this analysis. The parameters for which a RPA must be performed vary with the size and type of discharge. They are listed in the NPDES Permit Testing Requirements for Publicly Owned Treatment Works contained in Appendix J of 40 CFR Part 122. The relevant sections are reproduced below.

7.2.2.2 Reasonable Potential Analysis for pH

The pH of water is a measure of how acidic or basic a solution is. At a pH of 7.0, the solution is considered neutral. Most aquatic organisms can tolerate a fairly narrow range around 7.0. The federal secondary treatment standards for sewage treatment facilities includes a pH permit limit of 6.0 to 9.0 s.u. The Mid Coast Basin Water Quality Standard for pH is found in OAR 340-041-0220(1)(b). For fresh waters, the lower and upper criteria are 6.5 s.u. and 8.5 s.u. Dilution within the mixing zone will ensure that the standard is met at the edge of the mixing zone.

The existing NPDES permit limit for the City of Lincoln City effluent discharge has the pH to be within the range of 6.0-9.0 s.u. DEQ conducted a RPA of the effect of the discharge on the pH of Schooner Creek (see Attachment 3). The effluent input data for the spreadsheet are from the facility's existing permit. The ambient data for the spreadsheet are from DEQ monitoring station 35477-ORDEQ (Schooner Creek above Lincoln City STP) for the period of January 2015 to February 2016.

RPA shows that there is no reasonable potential for the discharge to cause pH concentrations in the receiving stream to fall below 6.5 s.u. or rise above 8.5 s.u. as long as the effluent pH remains between 6.2 and 9.0. Therefore, the proposed permit will have pH effluent limits of 6.2 to 9.0.

7.2.2.3 Reasonable Potential Analysis for Temperature

Water temperatures affect the life cycles of aquatic species and are a critical factor in maintaining and restoring healthy salmonid populations. The purpose of the temperature criteria in OAR 340-041-0028 is to protect designated, temperature-sensitive beneficial uses (including salmonid life cycle stages) from adverse warming caused by human activities.

DEQ uses Fish Use Designation and Salmon and Steelhead Spawning Use Designation maps to identify applicable temperature criteria for each basin. According to the Mid-Coast Basin maps, salmon and trout rearing and migration are year-round designated fish uses for Schooner Creek. The maps show that the creek supports spawning upstream of the wastewater treatment plant discharge but not at the discharge point. Schooner Creek is listed on the 303 (d) list for temperature year-round, but a TMDL has not been developed. Therefore, the temperature criterion for salmon and trout rearing and migration is 18 °C. Oregon's cold water protection rule (OAR 340-041-0028 (4)(c)) prohibits warming the ambient (i.e. receiving stream) temperature above 18 °C.

Since a TMDL has not been developed for temperature on Schooner Creek, OAR 340-041-0028(12)(b)(A) applies and the discharge cannot increase the temperature in Schooner Creek by more than 0.3 °C above the criterion of 18 °C at either the edge of the mixing zone or 25% of the stream flow, whichever is more restrictive. DEQ evaluated the effect of the discharge on the receiving stream temperature using data from the DMRs, ambient receiving stream temperatures, and the 2016 Mixing Zone Study to conduct a RPA for temperature during the summer and winter discharge season.

During the winter discharge period, the results of the RPA indicate that there is no potential for exceedance of the temperature criterion at the edge of the mixing zone or at 25% of the stream flow. Based on this result, the permit does not contain a thermal load permit limit for temperature during the winter discharge period (See Attachment 4). During the summer discharge period, the results of the RPA indicate that there is a reasonable potential for exceedance of the temperature criterion at the edge of the mixing zone and at 25% of the stream. The change in temperature is more restrictive at 25% of the stream flow. The RPA determined an excess thermal load limit of 10.7 million Kcals a day (See Attachment 5). The existing permit has an excess thermal load limit of 31 million Kcals a day, which is less restrictive than the current temperature analysis. Therefore, the proposed permit will require an excess thermal load limit of 10.7 million Kcals a day.

Thermal Plume

Plume Limitations in accordance with OAR 340-041-0053(2)(d) as follows:

- A. Impairment of an active salmonid spawning area where spawning redds are located or likely to be located. This adverse effect is prevented or minimized by limiting potential fish exposure to temperatures of 13 °C or less for salmon and steelhead, and 9 °C for bull trout;
- B. Acute impairment or instantaneous lethality is prevented or minimized by limiting potential fish exposure to temperatures of 32.0 °C or more for less than two seconds;
- C. Thermal shock caused by a sudden increase in water temperature is prevented or minimized by limiting potential fish exposure to temperatures of 25.0 °C or more to less than five percent of the cross section of 100 percent of the 7Q10 flow of the water body; DEQ may develop additional exposure timing restrictions to prevent thermal shock; and
- D. Unless the ambient temperature is 21.0 °C or greater, migration blockage is prevented or minimized by limiting potential fish exposure to temperatures of 21.0 °C or more to less than 25 percent of the cross section of 100 percent of the 7Q10 low flow of the water body.

As stated above, according to the Fish Use Designation maps, salmonid spawning occurs upstream of the treatment facility but not at or below the outfall discharge. Therefore, the discharge does not impair and active salmonid spawning area where spawning redds are located or likely to be located. The maximum temperature of the discharge year round, is 23 °C, which is in accordance with the Thermal Plume Limitation B listed above. To support the Thermal Plume Limitations for C and D above, DEQ used the RPA Thermal Plume calculator spreadsheet to determine if there is a reasonable potential to warm the creek above the criterion. The spreadsheet indicated that there is no reasonable potential for the discharge to violate the criterion and that the discharge is in accordance with the Thermal Plume Limitations (See Attachment 6 and Attachment 6A).

7.2.2.4 Reasonable Potential Analysis for Ammonia

Ammonia is a substance normally found in wastewater. The wastewater treatment processes, particularly aeration and biological treatment, can convert (oxidize) a large portion to nitrate and nitrite, but the treated effluent still contains some ammonia. After discharge, continued ammonia oxidation removes dissolved oxygen from the receiving stream. Un-oxidized ammonia is also a toxic agent and may have to be limited to prevent in-stream toxicity. Ammonia toxicity varies with pH and temperature of the water. Finally, ammonia and other nitrogen compounds are nutrients that can contribute to excessive biological growth that may cause violations of water quality standards. The problems could manifest as visual or aesthetic impairment or could be the cause of large fluctuations of dissolved oxygen or pH.

DEQ performed a RPA for ammonia toxicity in the wastewater effluent using the EPA approved spreadsheet. The calculations performed in the spreadsheet are based on the 1999 freshwater aquatic life criteria for ammonia that was approved by EPA on August 4, 2015. The results of the RPA for ammonia indicate that there is reasonable potential for the discharge to cause or contribute to exceedances of the water quality criteria for ammonia. Based on these results, the proposed permit will contain a Maximum Daily Limit (MDL) of Total Ammonia Nitrogen of 12.2 mg/L and an Average Monthly Limit (AML) of 5.3 mg/L (See Attachment 7).

7.2.2.5 Reasonable Potential Analysis for Chlorine

Chlorine is a strong chemical oxidizer that is toxic to many aquatic organisms. Its oxidizing properties also make it an effective disinfectant. Wastewater treatment plants, for example, often use it to kill bacteria in their effluent before discharging into waters of the state. The existing permit contains a permit limit for chlorine. However, the upgraded facility now uses ultraviolet (UV) light for disinfection of the bacteria in the effluent and no longer uses chlorine. Therefore, there is no reasonable potential for chlorine toxicity in the effluent and the proposed permit will no longer contain an effluent limit for total residual chlorine. The proposed permit will require daily monitoring and recording for UV intensity and dose.

7.2.2.6 Reasonable Potential Analysis for Copper

Oregon's freshwater copper criterion became effective on January 9, 2017. As described in OAR 340-041-8033 (under Table 30 Endnote N), the freshwater copper criteria are based upon the Biotic Lignin Model (BLM), a metal bioavailability model, which calculates the acute and chronic copper criteria based on the concentrations of certain parameters in the water. The BLM copper input parameters are Dissolved Organic Carbon (DOC), pH, Temperature, Calcium, Magnesium, Sodium, Potassium, Sulfate, Chloride, and Alkalinity.

When calculating the copper criterion using the BLM methodology it is important to understand that the criterion is calculated based on these ten input parameters. It is also important to understand how the input parameters influence the calculated criterion. DEQ conducted a statewide sensitivity analysis of the model and determined that model is most sensitive to DOC and pH. The copper criterion becomes more stringent with lower DOC and pH values. For typical concentrations observed in Oregon's waters, the other parameters have minimal impact on the criteria but are needed to calculate it.

Monthly paired effluent and ambient copper BLM input data was collected by Lincoln City staff and analyzed by various labs from July 2017 through May 2018. Ten paired samples were used for the analysis. Paired values were used to calculate the mixed concentration of each model input parameter at the edge of the ZID, mixing zone, and at complete mix using the respective dilution values from the mixing zone evaluation completed by DEQ on March 20, 2017. The mixed concentration of each input parameter was entered into the BLM model to calculate the Instantaneous Water Quality Criterion (IWQC) for each paired data set. Each IWQC was compared to the corresponding copper concentration calculated at the edge of the ZID, mixing zone, and complete mix. The table below shows the sample date, calculated criterion, calculated copper value, the toxic unit (copper concentration divided by the instantaneous criterion). A toxic unit greater than one, indicates there is a potential for the discharge to exceed the criterion. Multiple copper concentrations exceed the associated IWQC. The limits were calculated based on the conservative criteria calculated using the 10th% of the 10 individual acute and chronic

criterion. These values were entered into the freshwater copper criterion RPA worksheet and dissolved limits were calculated (See Attachment 8).

Table 2: Explanation of Copper BLM Results

Paired Analysis - Run 8/20/18									
Date	ZID	CMC	Toxic Units	MZ	CCC	Toxic Units	100%	CCC	Toxic Units
	Cu ug/L	ug/L		Cu ug/L	ug/L		Cu ug/L	ug/L	
7/5/2017	2.7	7.2	0.4	0.7	2.1	0.3	0.07	1.7	0.0
9/13/2017	2.1	10.3	0.2	0.5	2.4	0.2	0.05	1.3	0.0
10/4/2017	3.4	5.5	0.6	0.9	1.8	0.5	0.09	1.2	0.1
11/15/2017	3.6	2.6	1.4	0.9	1.2	0.7	0.09	1.3	0.1
12/6/2017	3.8	4.6	0.8	1.0	1.2	0.8	0.10	0.8	0.1
1/10/2018	3.0	2.2	1.4	0.8	0.8	0.9	0.08	0.8	0.1
3/21/2018	2.5	3.4	0.7	0.6	1.3	0.5	0.06	1.0	0.1
4/25/2018	3.1	3.7	0.8	0.8	1.0	0.8	0.08	0.7	0.1
5/23/2018	4.1	8.6	0.5	1.0	2.3	0.4	0.10	1.4	0.1
7/11/2018	3.0	8.2	0.4	0.8	2.3	0.3	0.08	1.4	0.1

Table 3: Calculated Copper Criteria Values (10th percentile)

RMZ	ZID	Complete Mix.
WQ Crit. CCC	WQ Crit. CMC	WQ Crit. CCC (Mix)
1.0 ug/l	2.5 ug/l	0.78 ug/l

Table 4: Copper Discharge Limits

Parameter	Units	Average Monthly	Daily Maximum
Copper (Total Recoverable)*	µg/L	1.8	3.1
Note:			
a. Total recoverable copper has been converted from dissolved copper using a translation factor. The translation factor for saltwater copper was used since a translation factor for freshwater copper is not available. See OAR 340-041-8033, Table 30.			

7.2.2.7 Reasonable Potential Analysis for Mercury

Oregon's water quality criterion for mercury is expressed in terms of a fish tissue concentration rather than a water column concentration. Because of this, DEQ's approach to performing the Reasonable Potential Analysis for mercury is different than other parameters. This approach is described in an Internal Management Directive entitled "Implementation of Methylmercury in NPDES Permits" and can be found at <https://www.oregon.gov/deq/Data-and-Reports/Pages/imd.aspx>.

According to the IMD, "Any facility contributing significant and consistent concentrations of total mercury to the receiving water body is considered to have the reasonable potential to exceed the water quality criterion unless a site-specific survey determines otherwise." Consistent with this, when mercury is detected in treated effluent on a consistent basis, the permit needs to

contain a WQBEL that consists of a Mercury Minimization Plan (MMP), continuing effluent monitoring and antidegradation provisions.

A review of monitoring data submitted by the City of Lincoln City indicates that total mercury is present in the discharge and therefore there is a reasonable potential to cause or contribute to the exceedance of the water quality standard. Accordingly, the City of Lincoln City will be required to develop and implement a MMP (Mercury Minimization Plan) tailored to the facility's potential to discharge mercury. Schedule A, Condition 7, of the proposed permit renewal contains the requirements for development and submittal of the MMP.

7.2.2.8 Reasonable Potential Analysis for Other Toxic Pollutants

As discussed at the beginning of this section, the City of Lincoln City is required to test their effluent to determine if it contains specific toxic substances at concentrations sufficient to cause toxicity to aquatic organisms or to affect human health. DEQ has conducted an RPA analysis on metals, cyanides, total phenols, volatile organic compounds, acid-extractable compounds, and base-neutral compounds. In accordance with 40 CFR § 122.21(j), a RPA was not conducted for pesticides or PCBs. Domestic facilities with a design flow greater than or equal to 1.0 MGD are only required to sample for these parameters known to be present in the facility's effluent, or for which the receiving water has been listed on the 303(d) list for these parameters. Schooner Creek has not been listed as water quality limited for any PCBs or Pesticides and the facility reported non-detect results in the NPDES application and stated that these parameters are not known to be present in the effluent.

Based on the results of the monitoring for the other required parameters and the RPA, dissolved zinc and total mercury were detected at end of pipe in the effluent (See Attachment 8). The RPA was previously discussed above in Section 7.2.2.7. The flows used in the analysis are listed below.

Table 5: Water Quality Standards - Applicable Flow Rates and Dilutions Used in Reasonable Potential Analysis

Water Quality Standards	Applicable River Flow Conditions	Applicable Effluent Flow Rate	Model-Predicted Dilution after Mixing
Aquatic Life, Freshwater Acute	17 cfs (1Q10)	Max. Daily: 3.55 MGD	1 at edge of ZID
Aquatic Life, Freshwater Chronic	40 cfs (7Q10)	Max. Monthly: 3.0 MGD	4 at edge of RMZ
Human Health, Non-Carcinogen	46 cfs (30Q5)	Avg. Dry Weather Design Flow: 3.0 MGD	4 at edge of RMZ
Explanation of terms: ZID - Zone of Initial Dilution RMZ - Regulatory mixing zone			

The results of the RPA are summarized in the following table.

Table 6: Summary of Results of Reasonable Potential Analysis

Parameter*	Criteria Type/ RPA Spreadsheet	Type	Description of Available Effluent Monitoring Data and RPA Results	Conclusion
Dissolved Zinc	Aquatic Life	Acute	RP at end of pipe	Permit limit based on aquatic criteria.
Total Mercury	Aquatic Life	Acute	No RP but detected in effluent	MMP based on aquatic criteria
<p>*Note: Parameters for which no reasonable potential was found are not included.</p> <p>Explanation of terms: RP - Reasonable Potential to cause or contribute to violations of water quality standards. No RP - No Reasonable Potential to cause or contribute to violations of water quality standards.</p>				

Based on the RPA results, the following permit limits are proposed for the City of Lincoln City:

Table 7: Permit Limits for Toxics

Parameter	Permit Limit: Monthly Average	Permit Limit: Daily Maximum	Comments
Total Recoverable Copper	1.8 µg/L	3.8 µg/L	WQBEL based on freshwater Aquatic Life Criteria
Total Recoverable Zinc	37.1 µg/L	64.3 µg/L	WQBEL based on Aquatic Life criteria.
Total Mercury	MMP	MMP	WQBEL

7.3 Schedule A: Waste Discharge Limits

The proposed permit limits for the City of Lincoln City are included in Schedule A of the permit. The numeric limits in Schedule A are reproduced below.

Schedule A – Waste Discharge Limits

1. Outfall 001 - Treated Effluent

a. BOD₅ and TSS

- i. May 1 – October 31: During this time period the permittee must comply with the limits in the following table:

Table A8: BOD₅ and TSS Limits

Parameter	Average Effluent Concentrations mg/L		Monthly Average lbs/day	Weekly Average lbs/day	Daily Maximum lbs
	Monthly	Weekly			
BOD ₅	10 mg/L	15 mg/L	250	380	500
TSS	10 mg/L	15 mg/L	250	380	500

- ii. November 1 – April 30: During this time period the permittee must comply with the limits in the following table:

Table A9: BOD₅ and TSS Limits

Parameter	Average Effluent Concentrations mg/L		Monthly Average lbs/day	Weekly Average lbs/day	Daily Maximum lbs
	Monthly	Weekly			
BOD ₅	20 mg/L	30 mg/L	750	1100	1500
TSS	20 mg/L	30 mg/L	750	1100	1500

Summer mass load limits based upon average dry weather design flow to the prior facility of 3.0 MGD. Winter mass load limits based upon average wet weather design flow to the prior facility equaling 4.5 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 6 MGD (twice the design average dry weather flow of the prior facility).

- b. Additional Parameters. Permittee must comply with the limits in the following table (year-round except as noted):

Table A10: Limits for Additional Parameters

Year-round (except as noted)	Limits
BOD ₅ and TSS Removal Efficiency	May not be less than 85% monthly average for BOD ₅ and TSS
Temperature	Maximum 7 day rolling average ETL may not exceed 10.7 million kcals/day
Fecal Coliform Bacteria	Monthly Median concentration may not exceed 56 organisms per 100 mL. No more than 10% of the samples collected in a calendar month may exceed 172 organisms per 100 mL.
pH	May not be outside the range of 6.2 to 9.0 S.U.
Total Ammonia Nitrogen	Monthly average concentration may not exceed 5.3 mg/L. Daily maximum concentration may not exceed 12.2 mg/L.
Copper (Total Recoverable) See Note a.	Monthly average concentration may not exceed 1.8 µg/L. Daily maximum concentration may not exceed 3.1 µg/L.
Total Zinc See Note b.	Monthly average concentration may not exceed 37.1 µg/L. Daily maximum concentration may not exceed 64.3 µg/L.
Notes:	
a. Total recoverable copper has been converted from dissolved copper using a translation factor. The translation factor for saltwater copper was used since a translation factor for freshwater copper is not available. See OAR 340-041-8033, Table 30.	
b. Total Zinc has been converted from dissolved zinc using a translation factor. See OAR 340-041-8033, Table 30.	

2. Outfall 002 - Recycled Water

May 1 – October 31

The permittee is authorized to distribute recycled water if it is:

- a. Treated and used according to the criteria listed in Table A11 below;
- b. Managed in accordance with the DEQ-approved Recycled Water Use Plan unless exempt as provided in Schedule D, Condition 4;
- c. Used in a manner and applied at a rate that does not have the potential to adversely impact groundwater quality;
- d. Applied at a rate and in accordance with site management practices that ensure continued agricultural, horticultural, or silvicultural production and does not reduce the productivity of the site; and
- e. Irrigated using sound irrigation practices to prevent:
 - i. Offsite surface runoff or subsurface drainage through drainage tile;

- ii. Creation of odors, fly and mosquito breeding, or other nuisance conditions; and
- iii. Overloading of land with nutrients, organics, or other pollutants.

Table A11: Recycled Water Limits

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
A	<p>Class A recycled water must be oxidized, filtered and disinfected. Before disinfection, turbidity may not exceed:</p> <ul style="list-style-type: none"> • 2 NTUs within a 24-hour period. • 5 NTUs more than five percent of the time within a 24-hour period. 10 NTUs at any time. <p>After disinfection, total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 2.2 organisms per 100 mL based on daily sampling over the last 7 days that analyses have been completed. • 23 organisms per 100 mL in any single samples. 	<p>Class A recycled water may be used for:</p> <ul style="list-style-type: none"> • Class B, C and D, and non-disinfected uses. • Irrigation for any agricultural or horticultural use. • Landscape irrigation of parks, playgrounds, schoolyards, residential landscapes, or other landscapes accessible to the public. • Commercial car washing or fountains when the water is not intended for human consumption. • Water supply source for non-restricted recreational impoundments.
B	<p>Class B recycled water must be oxidized and disinfected. Total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 2.2 organisms per 100 mL, based on the last 7 days that analyses have been completed. • 23 total coliform organisms per 100 mL in any single sample. 	<p>Class B recycled water may be used for:</p> <ul style="list-style-type: none"> • Class C and D and non-disinfected uses. • Stand-alone fire suppression systems in commercial and residential building, non-residential toilet or urinal flushing, or floor drain trap priming. • Water supply source for restricted recreational impoundments.

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
C	<p>Class C recycled water must be oxidized and disinfected. Total coliform may not exceed:</p> <ul style="list-style-type: none"> • A median of 23 total coliform organisms per 100 mL, based on results of the last 7 days that analyses have been completed. • 240 total coliform organisms per 100 mL in any two consecutive samples. 	<p>Class C recycled water may be used for:</p> <ul style="list-style-type: none"> • Class D and non-disinfected uses. • Irrigation of processed food crops; irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil. • Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses. • Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural firefighting using aircraft, street sweeping, or sanitary sewer flushing.

7.3.1 Discussion of Permit Limits

The limits are discussed below:

7.3.1.1 BOD₅, TSS Concentration, Mass Load and Percent Removal Limits

BOD₅ TSS can be thought of as indicators of the “strength” of the effluent. The development of the concentration and mass limits for BOD₅ and TSS are described in Section 7.2.1. As explained, these are TBELs.

The removal efficiency BOD₅ and TSS required by the permit is 85%. These removal efficiencies are rolled over from the previous permit as described in Section 6.2, and is consistent with the Code of Federal Regulations (40 CFR § 133) for any type of activated sludge system.

7.3.1.2 Excess Thermal Load (ETL)

The development of the ETL has been completed as described in Section 7.2.2.3.

a. Bacteria

Limits for bacteria are considered WQBELs. The City of Lincoln City discharges to Schooner Creek at river mile 1.1, which is fresh water but tidally influenced and then flows directly into the Siletz Bay. The Shellfish Growing Water maps in accordance with OAR 340-041-0220, Figure 220D, for the Mid Coast Basin, show that the Siletz Bay is designated a recreational shellfish growing water. The standard contained in OAR 340-041-0009(1)(b) for *fecal coliform* bacteria to protect recreational shell fishing is 14 *fecal coliform* organisms per 100 mL, with not more than ten percent of the samples exceeding 43 *fecal coliform* organisms per 100 mL. Recreational shell fishing does not occur within the mixing zone boundary and the available dilution of four will ensure the standard is achieved outside the mixing zone.

DEQ is proposing a *fecal coliform* bacteria permit limit of a monthly median of 56 *fecal coliform* organisms per 100 mL, with not more than ten percent of the samples exceeding 172 *fecal coliform* organisms per 100 mL. This limit is based on the available dilution and will ensure the standard is met at the edge of the mixing zone and be protective of the recreational shell fishing use in the Siletz Bay. The contact recreation standard for fresh water is 126 *E. coli* per 100 mL with no sample to exceed 406 *E. coli* per 100 mL. Since *E. coli* is a subset of *fecal coliform*, compliance with the proposed *fecal coliform* limit will ensure compliance with the contact recreation standard. DEQ is confident that this proposed limit will be protective of the designated uses.

b. pH

The derivation of pH limits is described in Section 7.2.2.2. These limits were developed with respect to the basin standards adjusted for dilution at edge of the mixing zone and are therefore WQBELs.

c. Ammonia

Ammonia is a substance normally found in wastewater. The wastewater treatment processes, particularly aeration and biological treatment, can convert a large portion to nitrate and nitrite, but the treated effluent still contains some ammonia. After discharge, the continued process of oxidizing the ammonia removes dissolved oxygen from the receiving stream.

Un-ionized ammonia is also a toxic agent and may have to be limited to prevent toxicity. The water outside the boundary of the mixing zone must be free of materials in concentrations that will cause chronic (sub-lethal) toxicity while the water outside the ZID must be free of pollutants that will cause acute toxicity.

Finally, nitrogen compounds (including ammonia) are nutrients that can contribute to excessive biological growth that cause violations of water quality standards. The problems could manifest as visual or aesthetic impairment or could be the cause of excessive dissolved oxygen or pH fluctuations.

If ammonia is discharged at a level that will cause, has the reasonable potential to cause, or contribute to an excursion above any state water quality standard (either as a nutrient or to prevent dissolved oxygen depletion or toxicity), ammonia must be limited by the permit.

The proposed permit contains ammonia limits that were discussed in Section 7.2.2.4. These limits were derived from calculations performed in the RPA spreadsheet for ammonia toxicity that are based on the 1999 freshwater aquatic life criteria that was approved by EPA on August 4, 2015.

7.3.2 Discussion of Other Schedule A Requirements

In addition to permit limits for specific parameters, Schedule A also contains requirements pertaining to the mixing zone, groundwater protection, recycled water, and biosolids requirements.

7.3.2.1 Mixing Zone

The current permit provides for a mixing zone defined as:

The allowable mixing zone is that portion of Schooner Creek within a band extending out 20 feet from the point of discharge and extending 200 feet upstream and downstream from the point of discharge. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within 20 feet of the point of discharge.

The City conducted a Level 2 Mixing Study during September 2016, and submitted a report to DEQ for review on December 30, 2016. The Mixing Zone study concluded that there does not appear to be any sensitive receptors in the immediate vicinity of the outfall that would be affected by the designated mixing zone. Special status fish species do pass through the area of the discharge however, the exposure time is minimal and likely reduced through avoidance behavior. Schooner Creek flows to an estuary that has many beneficial uses; however, these beneficial uses should be protected if water quality standards are met at the edges of the mixing zone. Therefore, the mixing zone is not proposed to change from the existing permitted mixing zone.

7.3.2.2 Groundwater Protection

The permit states that the permittee may not conduct any activities that could cause adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed of in a manner that prevents a violation of Groundwater Quality Protection Rules (OAR Chapter 340, Division 40).

7.3.2.3 Recycled Water

The permit describes the treatment criteria and management practices the permit holder must satisfy to distribute water for reuse. The requirements in Schedule A of the permit are derived from OAR 340-055.

7.3.2.4 Biosolids

The permit describes what discharge limits and management practices the City of Lincoln City must satisfy to beneficially reuse biosolids as a soil amendment or fertilizer. The requirements in Schedule A of the permit contain limits for biosolids and are derived from OAR 340-050. As of August 2016, the City has not been able to land apply treated biosolids on their approved sites because of too much nitrogen. The City is exploring new biosolids treatment and disposal options. In the interim period, the City will be using a dewatering centrifuge and hauling the solids to Coffin Butte Landfill for disposal.

7.3.2.5 Septage Requirements

The permit prohibits the City of Lincoln City from accepting septage for treatment or processing without written approval from DEQ.

7.3.2.6 Chlorine Usage

Because the City of Lincoln City uses UV disinfection, the permit prohibits the use of chlorine or chlorine compounds for disinfection. The use of chlorine is allowed for maintenance and the disinfection of recycled water for the purpose of reuse.

7.3.2.7 Mercury Minimization Plan

Because mercury has been detected in the permittee's effluent, the permittee must develop and implement a MMP (Mercury Minimization Plan) tailored to the facility's potential to discharge mercury. The permit lists the requirements of the plan. In year one of the permit, if mercury is detected above the quantitation limit in 25% or fewer of the samples, the mercury minimization plan may focus on the following elements:

- Develop and maintain mercury source tracking of potential private and public sources of mercury
- Prepare and distribute a mercury public education mailer
- Conduct quarterly monitoring in year 5 of the permit

7.4 Schedule B: Minimum Monitoring and Reporting Requirements

Section 1 of Schedule B describes monitoring and reporting protocols for the permit and includes the following:

- a. Sampling, Test Methods and Laboratory Quality Assurance and Quality Control (QA/QC)

- b. Re-analysis and Re-sampling if QA/QC Requirements Not Met
- c. Significant Figures and Rounding Conventions
- d. Reporting of Detection Levels and Quantitation Limits
- e. Reporting Sample Results
- f. Calculating and Reporting Mass Loads

Schedule B also describes the minimum monitoring and reporting necessary to demonstrate compliance with the conditions of this permit. The authority to require periodic reporting by permittees is included in ORS 468.065(5). Self-monitoring requirements are the primary means of ensuring that permit limits are being met. Other parameters may also need to be monitored when insufficient data exist to establish a limit, but where there is a potential for a water quality concern.

DEQ has developed monitoring and reporting matrices that establish monitoring and reporting frequencies based on the size and complexity of the facility. These matrices may be found at:

<https://www.oregon.gov/deq/FilterPermitsDocs/MonMatrix.pdf>

<https://www.oregon.gov/deq/FilterPermitsDocs/ReportingMatrix.pdf>

These matrices were used to establish the monitoring and reporting requirements for the City of Lincoln City.

In addition to monitoring and reporting requirements, Schedule B includes the following:

- Requirements to develop and implement a Quality Assurance/Quality Control (QA/QC) program
- What to do if QA/QC requirements are not met.
- Requirements pertaining to reporting procedures. These include:
 - The correct use of significant figures
 - Reporting of detection levels and quantitation limits
 - Calculating and reporting mass loads.

Monitoring requirements are found in the following tables:

Table B1: Influent Monitoring

Table B2: Effluent Monitoring

Table B3: Metals, Cyanide, total Phenols, Nitrates, Ammonia and Hardness

Table B4: Volatile Organic Compounds

Table B5: Acid-Extractable Compounds

Table B6: Base-Neutral Compounds

Table B7: Copper Biotic Ligand Model and Zinc Sampling Requirements

Table B8: Aluminum Sampling Requirements

Table B9: WET Test Monitoring

Table B10: Template for Reporting WET Test Results

Table B11: Recycled Water Monitoring

Table B12: Biosolids Monitoring

Table B13 Biosolids Minimum Monitoring Frequency

Table B14: Effluent Monitoring Required for NPDES Permit Application

Table B15: Reporting Requirements and Due Dates

Each of these tables is discussed in more detail below.

Tables B1 and B2: Influent and Effluent Monitoring

These tables specify the parameters to be monitored on a regular basis in the influent and effluent, along with associated monitoring frequencies, sample types and related reporting requirements. The effluent monitoring includes Alkalinity and Hardness for effluent characterization purposes. In addition, the effluent monitoring includes Total Recoverable Mercury Monitoring. The City of Lincoln City will be required to develop and implement a Mercury Minimization Plan tailored to the facility's potential to discharge mercury. The MMP will contain a 5 year plan with quarterly effluent monitoring during year one and year five of the permit.

Tables B3 through B6: Monitoring for Toxics Monitoring and Other Parameters

Because the City of Lincoln City discharges more than 1 mgd/day, the permit contains additional monitoring requirements for toxic pollutants. These parameters are listed in Tables B3 through B6 in Schedule B. The permit holder must collect a minimum of four samples for each of these parameters between the date of permit issuance and March 1, 2022. DEQ will then evaluate these results to determine if additional sampling will be needed.

If DEQ's analysis indicates that the permit holder's effluent may cause or contribute to exceedances of water quality standards at the point of discharge with no dilution present, the permit holder will be required to submit a sample and analysis plan for DEQ approval. The requirements for the sampling plan are listed in Schedule B, condition 5. The purpose of this follow-up monitoring will be to determine if the discharge has a reasonable potential to cause or contribute to exceedances of water quality for the toxics in question in Schooner Creek.

Note: Tables B3 through B6 list QLs for each parameter. DEQ recognizes that there are circumstances under which these QLs may not be achievable, such as when there are high TSS levels leading to matrix effects. In such circumstances, DEQ will allow re-sampling as described in Schedule B.

Table B7: Copper BLM and Zinc Sampling Requirements

EPA's criteria are based on the biotic lignin model (BLM). The BLM relies on ten input parameters in order to calculate the criterion. The proposed permit requires effluent and stream monitoring for these input parameters and for dissolved and total copper so that DEQ will have the needed information to evaluate this discharge relative to the copper BLM criteria at the next permit renewal.

Table B8: Aluminum Sampling Requirements

This table specifies the monitoring frequency and sampling location and time requirements for Aluminum.

Table B9: WET Test Monitoring

This table specifies the frequency, type and location of sampling needed to perform WET testing.

Table B10: Template for Reporting WET Test Results

This table is a template for reporting the date of test, organism, type test (chronic or acute), percentile of effluent at the ZID/RMZ, result, and percentile of effluent at the endpoint (NOEC, LOEC, or IC25).

Table B11: Recycled Water Monitoring Requirements

OAR 340-055-0012 requires the permittee to monitor and demonstrate compliance with the treatment criteria for a specific Class of recycled water. Table B11 lists the monitoring requirements consistent with OAR 340-055-0012. Specific monitoring and sampling procedures are described in the recycled water use plan.

Tables B12 and B13: Biosolids Monitoring Requirements and Monitoring Frequency

This table lists the monitoring requirements that pertain to biosolids, consistent with OAR 340-050-0035. Specific details on how and where biosolids monitoring will be conducted provided in the Biosolids Management Plan.

In addition to biosolids monitoring at the treatment facility, the facility is required to maintain records on the land application of biosolids. Records must be sufficient to demonstrate that biosolids were applied within agronomic loading rates and following required site management practices. The permit requires the permittee to record the date, quantity, and location of biosolids applied to the land on a site map or electronic GIS system.

Table B14: Effluent Monitoring Required for NPDES Permit Application

This table lists parameters for which monitoring data is required for the renewal of this permit.

Table B15: Reporting Requirements and Due Dates

This table summarizes, for the convenience of the permit holder, the information contained in the previously-listed tables.

7.5 Schedule C: Compliance Schedules and Conditions

The Clean Water Act requires that state-issued individual NPDES permits include effluent limits as stringent as necessary to meet water quality standards. Sometimes a permittee cannot immediately comply with new or newly applied water quality-based effluent limits upon the effective date of the permit because the permittee needs time to perform substantial modifications to their facility or processes in order to meet the new limits. Depending upon the circumstances, NPDES permits may include a series of required steps and deadlines (i.e., a compliance schedule), which upon completion, enables the permittee to meet the permit's water quality-based effluent limits (see 40 CFR § 122.47 and OAR 340-041-0061(12)). Interim effluent permit limits may also be included in certain circumstances.

On October 1, 2018, DEQ informed the City of Lincoln City that DEQ had completed an analysis for copper in the wastewater effluent using the Biotic Ligand Model and the RPA for copper discussed in Section 7.2.2.6, of this fact sheet. The analysis based on the monthly-paired effluent and ambient copper data collected by Lincoln City staff from July 2017 to May 2018. In accordance with the analysis, DEQ informed the City that it is proposing a new WQBEL in the NPDES permit for Total Recoverable Copper of a monthly average of 1.8 µg/L and a daily maximum of 3.1 µg/L. On December 13, 2018, Lincoln City staff responded in writing requesting a compliance schedule in the proposed permit because the existing wastewater treatment facilities would not be able to comply with the proposed copper limit and it will take time and modifications to the facilities in order to do so (See Attachment 9).

On February 20, 2019, DEQ informed the City that DEQ had completed an analysis for temperature using the RPA for a water quality limited stream for temperature when a Total Maximum Daily Load has not been completed as discussed in Section 7.2.2.3 of this fact sheet. In accordance with the RPA, DEQ informed the City that it is proposing a new ETL limit during the summer season of 10.7 million kcals/day. The City was also informed that DEQ had completed an analysis for zinc using an RPA for toxics. Based on the analysis, DEQ informed the City that it is proposing a new WQBEL in the NPDES permit for Total Recoverable Zinc of a monthly average of 37.1 µg/L and a daily maximum of 64.3 µg/L. In addition to the proposed temperature and zinc limits, DEQ informed the City that is proposing new WQBELs for *fecal coliform* bacteria of a monthly median of 56 *fecal coliform* organisms per 100 mL, with not more than ten percent of the samples exceeding 172 *fecal coliform* organisms per 100 mL. The new *fecal coliform* limit will be protective of both designated uses for contact recreation and recreational shell fishing.

On July 11, 2019, Lincoln City staff responded in writing requesting a compliance schedule in the proposed permit for all four proposed new permit limits; the ETL, the TRZ limits, the Fecal Coliform Bacteria limits and the previously discussed TRC limit. (See Attachment 10).

DEQ has reviewed the request for a compliance schedule and agrees that the City will not be able to meet the proposed limits upon issuance of the permit based on the following information submitted by the City in the request:

The City of Lincoln City wastewater treatment facility does not currently have adequate treatment units in place to remove copper and zinc in the effluent and meet the ETL limit prior to discharge. In addition, meeting the proposed bacteria limits may increase energy costs and ultimately require adding filtration prior to UV disinfection. The City will not be able to comply with these new limits upon permit issuance and needs time to:

- Acquire additional funding for public works projects through voter approval process;
- Complete ongoing sewer and water capital improvement projects in the current budget;
- Gather information and prepare an Analysis and Planning Report to achieve final effluent limitations for TRC, TRZ, ETL, and bacteria including but not limited to, monitoring, data analysis, surveys, and funding requirements;

- Submit a plan that evaluates engineering and non-engineering options available based on the analysis and planning report to achieve final effluent limitations for TRC, TRZ, ETL and bacteria;
- Secure adequate funding for developing a facility plan to identify upgrades, design engineering plans, and complete construction of new or upgraded facilities;
- Develop a facility plan to identify upgrade alternatives to meet the TRC, TRZ, ETL and bacteria effluent limits;
- Submit engineering plans and specifications of selected alternatives for DEQ approval; and,
- Submit a construction schedule for completing new or upgraded facilities to meet the TRC, TRZ, ETL and bacteria final effluent limits.

With City input, DEQ has developed a Schedule C compliance schedule in the proposed permit to meet the final TRC, TRZ, ETL limits and bacteria limits. The compliance schedule contains interim compliance dates and a final compliance date. The City has a responsibility to meet the compliance dates and must notify DEQ in writing of its compliance or noncompliance with the interim requirements. Given the complexity of the issues for the overall projects and the financial impacts of the project on the City, DEQ considers the proposed schedule to be reasonable, requires the final effluent limits to be met as soon as possible and is in compliance with 40 CFR § 122.47.

7.6 Schedule D: Special Conditions

7.6.1 Inflow and Infiltration

As described in Section 4.3 on the sewage collection system, it is important for the permit holder to assess and take steps to reduce the rate of infiltration and inflow of stormwater and groundwater into the sewer system. Consistent with this, Schedule D of the permit requires the permit holder to undertake activities to track and reduce I/I in the sewer system.

7.6.2 Emergency Response and Public Notification Plan

Municipal wastewater treatment facilities are required, under General Condition B.8. in Schedule F, to have an Emergency Response and Public Notification Plan.

7.6.3 Recycled Water Use Plan

Conditions requiring the permit holder to develop and maintain a recycled water use plan are provided in Schedule D. The recycled water use plan must meet the requirements in OAR 340-055-0025 and include location-specific information describing where and how recycled water is managed to protect public health and the environment. At least six months prior to distributing recycled water for beneficial use, the permittee must submit to DEQ a Recycled Water Use Plan for public comment and approval. All of the recycled water reuse sites must be registered with the Oregon Water Resources Department. The recycled water use plan must address comments from the Oregon Health Authority's review (A completed Recycled Water Use Plan Summary

Form will need to be completed and provided for public comment prior to distributing recycled water for beneficial use). If Class A recycled water is to be used for the beneficial purpose of artificial groundwater recharge, a recycled water use plan must also include, but is not limited to, the following:

A groundwater monitoring plan in accordance with OAR 340-040-0030(2);

- A determination if the recharge will be to a drinking water protection area;
- A description of the soil characteristics;
- The distance from the recharge area to the nearest point of withdrawal and the retention time in the aquifer until the time of withdrawal; and
- Verification from Oregon Water Resources Department that a request for authorization for this use has been initiated.

7.6.4 Exempt Wastewater Reuse at the Treatment System

Schedule D exempts the permit holder from the recycled water requirements in OAR 340-055, when recycled water is used for landscape irrigation at the treatment facility or for in-plant processes, such as in plant maintenance activities. Landscape irrigation includes water applied to small-scale irrigation such as supplying supplemental irrigation to turf grass, shrubs, and ornamental trees. Landscape irrigation may include the irrigation of native vegetation along dikes, banks, and earthen impounds around wastewater lagoons—especially as needed to reduce erosion and maintain structural integrity. Landscape irrigation does not include large-scale of pasture, hayfields, or native vegetation adjacent to wastewater treatment facility (i.e., these activities are subject to OAR 340-055 and require development of a recycled water use plan). All of the conditions listed in (6)(i) through (6)(iv), Schedule D of the permit must be satisfied for an exempt use to be valid.

7.6.5 Biosolids Management Plan and Land Application Plan

Conditions requiring the permit holder to develop and maintain a biosolids management plan and land application plan are provided in Schedule D. The biosolids management plan and the land application plan must meet the requirements in OAR 340-050-0031 and describe where and how the land application of biosolids is managed to protect public health and the environment.

The land application plan includes all sites authorized by DEQ for land application of Class B biosolids and described in individual, DEQ-issued site authorization letters. During permit renewal, all previously authorized biosolids land application sites are available for public comment with the biosolids management plan and land application plan. During the term of the permit, DEQ-initiated public notice of previously authorized sites identified in the land application plan is not required.

When the permit holder needs a new land application site, the permit holder is responsible for getting authorization from DEQ as well as notifying neighbors and providing them with an opportunity to comment. Any proposed new site must meet the site selection and site management criteria described in the land application plan. DEQ-initiated public notice will be provided for any new site that does not meet these criteria and/or that DEQ considers sensitive with respect to residential housing, runoff potential, and/or threat to groundwater.

A biosolids management plan was submitted to DEQ and approved on October 17, 2003. Since August 2016, the City has not been able to land apply treated biosolids on their approved sites because of too much nitrogen and has had to put the solids in the sludge holding lagoons. From January 1, 2017, until August 2017, the City put approximately 124.8 dry tons of biosolids in the sludge holding lagoons. On August 10 2017, the City brought on-line a temporary sludge-dewatering centrifuge and is now dewatering and hauling all of the solids to Coffin Butte landfill.

If the facility produces Exceptional Quality (EQ) biosolids, the permittee is exempt from the requirements to obtain written authorization from DEQ for land application sites and to provide public notice on proposed land application sites. EQ biosolids are highly treated solids in which pollutant concentrations are less than the pollutant concentration limits in Schedule A, pathogen reduction requirements for Class A biosolids have been met, and vector attraction reduction requirements have been met.

7.6.6 Wastewater Solids Transfers

The permit allows the facility to transfer treated or untreated wastewater solids to other in-state or out-of-state facilities that are permitted to accept the wastewater solids. The permittee is required to monitor, report, and dispose of solids as required by the permit of the receiving facility. Wastewater solids that are transferred out-of-state must meet all requirements for the use of disposal or wastewater solids as required by both Oregon and the receiving state.

7.6.7 Whole Effluent Toxicity Testing

As discussed previously, the permit holder is required to conduct WET tests to determine the aggregate effect of the effluent on aquatic organisms. EPA has developed protocols for performing these tests and for determining the percentage of effluent that produces an adverse effect on a group of test organisms. The language in this section of the permit describes the test procedures to be followed.

7.6.8 Operator Certification

The permit holder is required to have a certified operator consistent with the size and type of treatment plant covered by the permit. The language in this section of the permit describes the requirements relating to operator certification. An updated copy of the wastewater classification worksheet for the City of Lincoln City is Attachment 2.

7.6.9 Industrial User Survey

The permit holder is required to conduct an industrial user survey every five years. The purpose of the survey is to identify whether there are any categorical industrial users discharging to the POTW, and ensure regulatory oversight of these discharges to state waters.

7.7 Schedule E: Pretreatment

The City of Lincoln City conducted an Industrial User Survey during the last permit cycle and determined that a DEQ-approved industrial pretreatment program is not needed. No categorical industrial users were identified in the IU survey update submitted with the city's permit renewal application.

7.8 Schedule F: NPDES General Conditions

These conditions are standard to all domestic NPDES permits and include language regarding operation and maintenance of facilities, monitoring and record keeping, and reporting requirements. The General Conditions for all individual permits issued by DEQ were substantially revised in August 2009. Minor modifications have been made since then. A summary of the changes is as follows:

- There are additional citations to the federal Clean Water Act and CFR, including references to standards for sewage sludge use or disposal.
- There is additional language regarding federal penalties.
- Bypass language has been made consistent with the Code of Federal Regulations and with other EPA Region 10 states.
- Reporting requirements regarding overflows have been made more explicit.
- Requirements regarding emergency response and public notification plans have been made more explicit.
- Language pertaining to duty to provide information has been made more explicit.
- Confidentiality of information is addressed.

8. Next Steps

8.1 Public Comment Period

The proposed NPDES permit will be made available for public comment for a minimum of 35 days. Public notice and links to the proposed permit will be posted on DEQ's website and sent to subscribers to DEQ's pertinent public notice e-mail lists. A Public Hearing will be scheduled if requested by 10 or more people, or by an authorized person representing an organization of at least 10 people. If a public hearing is held, then an additional public notice would be published to advertise the public hearing.

8.2 Response to Comments

DEQ will respond to comments received during the comment period. All those providing comment will receive a copy of DEQ's response. Interested parties may also request a copy of DEQ's response. Once comments are received and evaluated, DEQ will decide whether to issue the permit as proposed, to make changes to the permit, or to deny the permit. DEQ will notify the permittee of DEQ's decision.

8.3 Modifications to Permit Evaluation Report and Fact Sheet

Depending on the nature of the comments and any changes made to the permit as result of comments, DEQ may modify this permit evaluation report and fact sheet. DEQ may also choose to update the permit evaluation report and fact sheet through memorandum or addendum. If substantive changes are made to the permit, an additional round of public comment may occur.

8.4 Issuance

DEQ mails the finalized, signed permit to the permittee.

Attachment 1 Antidegradation Review Worksheet

Attachment 1 Anti-degradation Review Worksheet for a Proposed Individual NPDES Discharge

Applicant: **City of Lincoln City**

1. What is the name of the surface water that receives the discharge? **Schooner Creek**

Briefly describe the proposed activity: **NPDES Permit Renewal**

This review is for a: **Renewal**

Go to **Step 2**.

2. Are there any existing uses associated with the water body that are not included in the list of designated uses? Example: DEQ's Fish Use Designation Maps identify the waterbody as supporting salmonid migration; however ODFW has determined that it also supports salmonid spawning.

No. Go to **Step 3**

3. Was the analysis of the impact of the proposed activity performed relative to criteria applicable to the most sensitive beneficial use?

Yes. Go to **Step 4**.

4. Is this surface water an **Outstanding Resource Water** or **upstream** from an **Outstanding Resource Water**? Note: No waters in Oregon have been designated as Outstanding Resource Waters. OAR 340-041-0004(8)(a) contains criteria for designating such waters. Example: they are found in State or National parks.

No. Go to **Step 5**.

5. Is this surface water a **High Quality Water**? A High Quality Water is one for which none of the pollutants are Water Quality Limited. To determine, go to the database at <http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp> and under Listing Status, select "Water Quality Limited – All (Categories 4 and 5)".

No. Go to **Step 6**.

6. Is this surface water a **Water Quality Limited Water**? To determine, use the same database query as Step 5.

Yes. Go to **Step 16**.

7. Will the proposed activity result in a permanent new or expanded source of pollutants directly to or affecting the **Outstanding Resource Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or in-

creased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Anti-degradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications.*]

Yes, Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)

No. Please provide basis for conclusion: . [Go to Step 8.](#)

8. Will the proposed activity result in a lowering of water quality in the **Outstanding Resource Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Antidegradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications.*]

Yes. Provide basis for conclusion: . [Go to Step 9.](#)

No. Provide basis for conclusion: . [Go to Step 20.](#)

9. If the proposed activity results in a non-permanent new or expanded source of pollutants directly to or affecting an **Outstanding Resource Water**, will the lowering of water quality in the **Outstanding Resource Water** be on a short-term basis in response to an emergency or to protect human health and welfare?

Yes. Proceed with Application Process to Interagency Coordination and Public Comment. [Go to Step 23.](#)

No. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 20.](#)

10. Will the proposed activity result in a Lowering of Water Quality in the **High Quality Water**[see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Antidegradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications.*]

Yes. [Go to Step 11.](#)

No. Proceed with Permit Application. Applicant should provide basis for conclusion: . [Go to Step 23.](#)

11. OAR 340-041-0004(6)(c) of the *High Quality Waters Policy* requires that the Department evaluate the application to determine that all water quality standards will be met and beneficial uses protected after allowing discharge to **High Quality Waters**. Will all water quality standards be met and beneficial uses protected?

Yes. Provide basis for conclusion: . Proceed with Application Process to Interagency Coordination and Public Comment. [Go to Step 12.](#)

No. Provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)

12. OAR 340-041-0004(6)(a) of the High Quality Waters Policy requires that the Department evaluate the application to determine if no other reasonable alternatives exist except to discharge to High Quality Waters. At a minimum, the following list must be considered:

- Improved operation and maintenance of existing treatment system
- Recycling or reuse with no discharge
- Discharge to on-site system
- Seasonal or controlled discharges to avoid critical water quality periods
- Discharge to sanitary sewer
- Land application

Were any of the alternatives feasible?

Yes. Provide basis for conclusion (see below for information requirements): Recommend Preliminary Decision that applicant use alternative. [Go to Step 10.](#)

No. Provide basis for conclusion (see below for information requirements): [Go to Step 13.](#)

In a separate statement to this application, please explain the *technical feasibility* of the alternative, explain the *economic feasibility* of the alternative, and provide an *estimated cost* of NPDES permit alternative for a five-year period from start-up.

13. OAR 340-041-0004(6)(b) of the *High Quality Waters Policy* requires that the Department evaluate the application to determine if there are social and economic benefits that outweigh the environmental costs of allowing discharge to High Quality Waters. Do the social and economic benefits outweigh the environmental costs of lowering the water quality?

Yes. Provide basis for conclusion (see below for information requirements): [Go to Step 14.](#)

No. Provide basis for conclusion (see below for information requirements): [Go to Step 23.](#)

The basis for conclusion should include a discussion of whether the lowering of water quality is necessary and important. "Necessary" means that the same social and economic benefits cannot be achieved with some other approach. "Important" means that the value of the social and economic benefits due to lowering water quality is greater than the environmental costs of lowering water quality.

Benefits can be created from measures such as:

- Creating or expanding employment (provide current/expected number of employees, type & relative amount of each type)
- Increasing median family income

- Increasing community tax base (provide current/expected annual sales, tax info)
- Providing necessary social services
- Enhancing environmental attributes

Environmental Costs can include:

- Losing assimilative capacity otherwise used for other industries/development
 - Impacting fishing, recreation, and tourism industries negatively
 - Impacting health protection negatively
 - Impacting societal value for environmental quality negatively
14. OAR 340-041-0004(6)(d) of the *High Quality Waters Policy* requires that DEQ prevent federal threatened and endangered aquatic species from being adversely affected. Will lowering the water quality likely result in adverse effects on federal threatened and endangered aquatic species?
- Yes, please provide basis for conclusion (see below for information requirements): Go to Step 23.
- No, please provide basis for conclusion (see below for information requirements): Go to Step 15.
15. Will lowering water quality in the **High Quality Water** be on a short-term basis in response to an emergency or to protect human health and welfare?
- Yes, go to Step 20.
- No, recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 23
16. Will the proposed activity result in a lowering water quality in the **Water Quality Limited Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Anti-degradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications*.]
- No, proceed with Permit Application. Permit writer should provide basis for determination in permit evaluation report: Go to Step 23.
- This conclusion is explained and supported by data and evaluations included with the Proposed Permit Evaluation Report and attachments accompanying the Proposed NPDES permit renewal. This an existing discharge and there is no request for a Mass Load Increase. The discharge must meet the water quality criteria for all parameters at the edge of the mixing zone.**

17. OAR 340-041-0004(9)(a)(A) of the *Water Quality Limited Waters Policy* requires that the Department evaluate the application to determine that all water quality standards will be met. Will all water quality standards be met?
- Yes, please provide basis for conclusion: [Go to Step 18.](#)
- No, please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)
18. OAR 340-041-0004(9)(a)(C) of the *Water Quality Limited Waters Policy* requires that the Department evaluate the application to determine that all recognized beneficial uses will be met and that threatened or endangered species will not be adversely affected. Will all beneficial uses be met and will threatened or endangered species be protected from adverse effects?
- Yes, please provide basis for conclusion: [Go to Step 19.](#)
- No, please provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)
19. OAR 340-041-0004(9)(a)(D)(i-iv) of the *Water Quality Limited Waters Policy* requires that the Department evaluate the application for *one of the following*:
- 19A. Will the discharge be associated (directly or indirectly) with the pollution parameter(s) causing the waterbody to be designated a Water Quality Limited Water?
- Yes, please provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)
- No, please provide basis for conclusion: [Go to Step 20.](#)
- 19B. Have TMDLs, WLAs, LAs, and reserve capacity been established, compliance plans been established, and is there sufficient reserve capacity to assimilate the increased load under the established TMDL?
- Yes, please provide basis for conclusion: [Go to Step 20.](#)
- No, please provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)
- 19C. Will the proposed activity meet the requirements, as specified under OAR 340-041-0004(9)(a)(D)(iii) of the *Water Quality Limited Waters Policy*, for dissolved oxygen?
- Yes, please provide basis for conclusion: [Go to Step 20.](#)
- No, please provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)
- 19D. Will the activity solve an existing, immediate, and critical environmental problem?
- Yes, please provide basis for conclusion: [Go to Step 20.](#)

No, please provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)

20. Is the proposed activity consistent with local land use plans?

Yes, [go to Step 21.](#)

No, please provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)

21. OAR 340-041-0004(9)(c)(A) requires the Department to consider alternatives to lowering water quality. At a minimum, the following list must be considered:

- Improved operation and maintenance of existing treatment system
- Recycling or reuse with no discharge
- Discharge to on-site system
- Seasonal or controlled discharges to avoid critical water quality periods
- Discharge to sanitary sewer
- Land application

Were any of the alternatives feasible?

Yes, please provide basis for conclusion (see below for information requirements): Recommend Preliminary Decision that applicant use alternative. [Go to Step 16.](#)

No, please provide basis for conclusion (see below for information requirements): [Go to Step 22.](#)

In a separate statement to this application, please explain the *technical feasibility* of the alternative, explain the *economic feasibility* of the alternative, and provide an *estimated cost* of NPDES permit alternative for a five-year period from start-up.

22. OAR 340-041-0004(9)(c)(B) of the *Water Quality Limited Waters Policy* requires the Department to consider the economic effects of the proposed activity, which in this context consists of determining if the social and economic benefits of the activity outweigh the environmental costs of allowing a lowering of water quality. Do the social and economic benefits outweigh the environmental costs of lowering the water quality?

Yes. Provide basis for conclusion: Proceed with Application Process to Interagency Coordination and Public Comment. [Go to Step 23.](#)

No. Provide basis for conclusion: Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). [Go to Step 23.](#)

The basis for conclusion should include a discussion of whether the lowering of water quality is necessary and important. "Necessary" means that the same social and economic benefits cannot be

achieved with some other approach. "Important" means that the value of the social and economic benefits due to lowering water quality is greater than the environmental costs of lowering water quality.

Benefits can be created from measures such as:

- Creating or expanding employment (provide current/expected number of employees, type & relative amount of each type)
- Increasing median family income
- Increasing community tax base (provide current/expected annual sales, tax info)
- Providing necessary social services
- Enhancing environmental attributes

Environmental Costs can include:

- Losing assimilative capacity otherwise used for other industries/development
- Impacting fishing, recreation, and tourism industries negatively
- Impacting health protection negatively
- Impacting societal value for environmental quality negatively

23. On the basis of the Anti-degradation Review, the following is recommended:

Proceed with Application to Interagency Coordination and Public Comment Phase.

ACTION APPROVED

Review prepared by DEQ, [go to DEQ info](#)

DEQ info

Name: **Robert Dicksa**

Phone: **503-378-5039**

Date Prepared: **January 25, 2017**

Attachment 2 Wastewater System Classification Worksheet for Operator Certification

Oregon Department of Environmental Quality Wastewater System Classification Worksheet for Operator Certification			
STEP 1: Criteria for Classifying Wastewater Treatment Systems (OAR 340-049-0025)			
NOTE: see bottom two spreadsheet tabs for Worksheet Instructions & Worksheet Information. See Classification chart at bottom of this worksheet for Classes I-IV.			
Wastewater System Common Name:	Lincoln City STP		
Location:	5000 SE Port, Lincoln City, Oregon	Region:	Western
County:	Lincoln	Date:	1/26/2017
Facility File #:	50677	Classified by:	Robert Dicksa
Design ADWF (Influent MGD):	3.0 MGD	WWC Class:	3
Design Population*:	30,000	WWT Class:	4
Design BOD (Influent lbs/day):		Small WWS:	
		If Small WWS, # of connections:	
Is this a change from a prior classification? (yes/no)	NO	Total Points:	81.0
1. Design Population:	30,000	or Population Equivalent	
Based on:	Flow (gallons/person/day)	BOD (pounds/person/day)	
WWC Classification	(based on population size)		
Less than 500	Eligible for Small WW System classification if treatment point		
1500 or less	WWC Class 1		
1501 to 15,000	WWC Class 2		
15,001 to 50,000	WWC Class 3		
over 50,000	WWC Class 4		
WWT Classification	(based on total points)		
Less than 750			0.5
751 to 2,000			1.0
2,001 to 5,000			1.5
5,001 to 10,000			2.0
Greater than 10,000	(3 + 1 for each additional 10 K)		3.0 3.0
2. Average Dry Weather Flow (Design Capacity)			
Less than 0.075 MGD			0.5
Greater than 0.075 MGD to 0.1 MGD			1.0
Greater than 0.1 to 0.5 MGD			1.5
Greater than 0.5 to 1.0 MGD			2.0
Greater than 1.0 MGD	(3 + 1 for each additional 1.0 MGD)		3.0 5.0
3. Unit Processes			
<i>Preliminary Treatment and Plant Hydraulics</i>			
Comminution (cutter, shredder, grinder, barminutor, etc.)			1.0
Grit Removal (gravity)			1.0
Grit Removal (mechanical)			2.0 2.0
Screen(s) (in-situ or mechanical, coarse solids only)			1.0 1.0
Pump/Lift Station(s) (pumping of main flow)			2.0 2.0
Flow Equalization (any type)			1.0

<i>Primary Treatment</i>			
Community Septic Tank(s) (STEP, STEG, etc.)		2.0	
Clarifier(s)		5.0	
Flotation Clarifier(s)		7.0	
Chemical Addition System		2.0	2.0
Imhoff Tanks (large septic tank or similar sedimentation & digestion)		3.0	
<i>Secondary, Advanced, and Tertiary Treatment</i>			
Low Rate Trickling Filter(s) (no recirculation)		7.0	
High Rate Trickling Filter(s) (recirculating)		10.0	
Trickling Filter - Solids Contact System		12.0	
Activated Sludge (includes SBR & basic MBR process)		15.0	15.0
Pure Oxygen Activated Sludge		20.0	
Activated Bio Filter Tower (less than 0.1MGD)		6.0	
Activated Bio Filter Tower (greater than 0.1MGD)		12.0	
Rotating Biological Contactors (1 to 4 shafts)		7.0	
Rotating Biological Contactors (5 or more shafts)		12.0	
Stabilization Lagoons (1 to 3 cells without aeration)		5.0	
Stabilization Lagoons (1 or more cells with primary aeration)		7.0	
Stabilization Lagoons (2 or more cells with full aeration)		9.0	
Recirculating Gravel Filter (or recirculating textile filters)		7.0	
Chemical Precipitation Unit(s)		3.0	
Gravity Filtration Unit(s)		2.0	
Pressure Filtration Unit(s)		4.0	
Nitrogen Removal (Biological (BNR) or Chemical/Biological System)		4.0	4.0
Nitrogen Removal (Design Extended Aeration Only - Nitrification)		2.0	
Phosphorous Removal Unit(s)		4.0	
Effluent Microscreen(s)		2.0	2.0
Chemical Flocculation Unit(s)		3.0	
Ultra Filtration Membrane(s)		15.0	
Chemical Addition System	Description: add alkalinity	2.0	2.0
<i>Solids Handling (excludes long-term storage in treatment lagoons above)</i>			
Anaerobic Primary Sludge Digester(s) w/o Mixing and Heating		5.0	
Anaerobic Primary Sludge Digester(s) with Mixing and Heating		7.0	
Anaerobic Primary and Secondary Sludge Digesters		10.0	
Sludge Digester Gas Reuse		3.0	
Aerobic Sludge Digester(s)		8.0	8.0
Sludge Storage Lagoon(s) (List Basin(s) or Tank(s) in Step 2)		2.0	2.0
Sludge Lagoon(s) with Aeration		3.0	3.0
Sludge Drying Bed(s)		1.0	
Sludge Air or Gravity Thickening		3.0	
Sludge Composting (in Vessel)		12.0	
Sludge Belt(s) or Vacuum Press/Dewatering		5.0	
Sludge Centrifuge(s)		5.0	
Sludge Incineration		12.0	
Sludge Chemical Addition Unit(s) (alum, polymer, alkaline stab, etc.)		2.0	
Non-Beneficial Sludge Disposal (landfill or burial)		1.0	
Beneficial Sludge Utilization (see also Step 2)		3.0	3.0
Solids Reduction Processing		4.0	
<i>Disinfection</i>			
Liquid Chlorine Disinfection		2.0	
Gas Chlorine Disinfection		5.0	
Dechlorination System		4.0	
Other Disinfection System including Ultraviolet and Ozonation		5.0	5.0
On-Site Chlorine Generation of Disinfectants		5.0	
4. Effluent Permit Requirements			
Minimum of Secondary Effluent Limitation for BOD and/or TSS		2.0	
Minimum of 20 mg/L BOD and/or Total Suspended Solids		3.0	3.0
Minimum of 10 mg/L and/or Total Suspended Solids		4.0	
Minimum of 5 mg/L BOD and/or Total Suspended Solids		5.0	
Effluent Limitations for Effluent Oxygen		1.0	
Other Limits (see Step 2)			

4. Effluent Permit Requirements		
Minimum of Secondary Effluent Limitation for BOD and/or TSS	2.0	
Minimum of 20 mg/L BOD and/or Total Suspended Solids	3.0	3.0
Minimum of 10 mg/L and/or Total Suspended Solids	4.0	
Minimum of 5 mg/L BOD and/or Total Suspended Solids	5.0	
Effluent Limitations for Effluent Oxygen	1.0	
Other Limits (see Step 2)		

5. Variation in Raw Waste		
<i>Points in this category will be awarded only when conditions are extreme to the extent that operation and handling procedure changes are needed to adequately treat waste due to variation of raw waste (strength or flow).</i>		
Recurring deviations or excessive variations (100 - 200 %)	2.0	
Recurring deviations or excessive variations of more than 200 %, or conveyance and treatment of industrial wastes covered by the pretreatment program.	4.0	
Septage or truck-hauled waste	2.0	2.0

6. Sampling and Laboratory Testing		
Sample for BOD, Total Suspended Solids (performed by outside lab)	2.0	
BOD or Total Suspended Solids analysis (performed at treatment plant)	4.0	4.0
Bacteriological analysis (performed by outside lab)	1.0	
Bacteriological analysis (performed at wastewater treatment plant lab)	2.0	2.0
Nutrient, Heavy Metals, or Organic analysis (performed by outside lab, ≤ 1 per month = 1 pt)	3.0	1.0
Nutrient, Heavy Metals or Organic analysis (performed at W/TP)	5.0	
	Points based on 340-049-0025:	71.0

Classification based on 340-049-0025 Class 3

STEP 2: Complexity Reflected in OAR 340-049 0020(4)

Note: Include additional points from Step 2 only if the complexity of the wastewater treatment system is not reflected in the points from Step 1. Be sure to justify any additional points from Step 2 in the permit Fact Sheet. Points shown below are given as guidance.

Fine Screen Preliminary Treatment (includes washing & compaction)	2.0	
SCADA or similar instrumentation providing data/w process op.	2.0 - 4.0	3.0
Post-aeration (includes mechanical and diffused aeration - not cascade)	1.0	1.0
Class A recycled water (storage, distribution & monitoring)	6.0	6.0
Class B, C, D and Non-disinfected Recycle (surface & subsurface)	3.0	
Sludge dewatering using bag or tube system	1.0	
Solids Composting (ASP or windrow)	6.0	
Land application of biosolids by system operator	5.0	
Odor or corrosion control (separate or combined)	2.0	
Chemical/physical advanced waste treatment	10 - 15.0	
Reverse Osmosis, Electro-dialysis, Membrane Filtration	15.0	
Standby power	1.0 - 3.0	
Digester Gas Recovery Systems	1.0 - 3.0	
Other Effluent Limitations (describe below)	1.0	

Description:		
	Total	81.0

Classification based on 340-049-0025 Class 4

Attachment 3 pH

Calculation of pH of a mixture of two flows in Fresh Waters.

Basic calculations are based on the procedure in EPA's DESCION program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

Facility Name: City of Lincoln City	RPA for pH	
INPUT	Lower pH	Upper pH
	Criteria	Criteria
1. DILUTION FACTOR AT MZ BOUNDARY - $(Q_e+Q_r)/Q_e$	4.0	4.0
2. UPSTREAM/BACKGROUND CHARACTERISTICS @ Critical Flow		
Temperature (deg C):	13.9	13.9
pH:	7.1	7.7
Alkalinity (mg CaCO ₃ /L):	25.0	25.0
3. EFFLUENT CHARACTERISTICS		
Temperature (deg C):	20.0	20.0
pH:	6.2	9.0
Alkalinity (mg CaCO ₃ /L):	75.0	75.0
4. APPLICABLE PH CRITERIA	6.5	8.5
OUTPUT		
1. IONIZATION CONSTANTS		
Upstream/Background pKa:	6.43	6.43
Effluent pKa:	6.38	6.38
2. IONIZATION FRACTIONS		
Upstream/Background Ionization Fraction:	0.82	0.95
Effluent Ionization Fraction:	0.40	1.00
3. TOTAL INORGANIC CARBON		
Upstream/Background Total Inorganic Carbon (mg CaCO ₃ /L):	30.33	26.34
Effluent Total Inorganic Carbon (mg CaCO ₃ /L):	189.04	75.18
4. CONDITIONS AT MIXING ZONE BOUNDARY		
Temperature (deg C):	15.43	15.43
Alkalinity (mg CaCO ₃ /L):	37.50	37.50
Total Inorganic Carbon (mg CaCO ₃ /L):	70.01	38.55
pKa:	6.42	6.42
pH at Mixing Zone Boundary:	6.479	7.969
Is there Reasonable Potential?	No	No

Attachment 4 Human Use Allowance Worksheet - Winter

Human Use Allowance - Stream Exceeds Water Quality Criterion (OAR 340-041-0028(12)(b)(A))

Analysis at Edge of Mixing Zone and 25% Stream Flow
Section 5.3 of the Temperature IMD

Attachment 4

Facility Name: Lincoln City - Winter

Date: 2/13/2019

Enter data into white cells below:

Mixing Zone Dilution = 4

7Q10 = 40 cfs

Effluent Flow = 3 mgd

Applicable Temperature Criterion = 18 °C

Effluent Temperature = 18.9 °C

Allowable increase = 0.3 °C

Dilution at 25% Stream Flow = 3

ΔT at edge of MZ=	0.23 °C	No Reasonable Potential
ΔT at 25% Stream Flow=	0.29 °C	

Thermal Load Limit =	N/A	Million Kcals
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Attachment 5 Human Use Allowance - Summer

Human Use Allowance - Stream Exceeds Water Quality Criterion (OAR 340-041-0028(12)(b)(A)) Analysis at Edge of Mixing Zone and 25% Stream Flow Section 5.3 of the Temperature IMD

Attachment 5

Facility Name: Lincoln City - Summer

Date: 2/13/2019

Enter data into white cells below:

Mixing Zone Dilution = 4

7Q10 = 40 cfs

Effluent Flow = 3 mgd

Applicable Temperature Criterion = 18 °C

Effluent Temperature = 23.3 °C

Allowable increase = 0.3 °C

Dilution at 25% Stream Flow = 3

ΔT at edge of MZ=	1.33 °C	Reasonable Potential
ΔT at 25% Stream Flow=	1.68 °C	

Thermal Load Limit =	10.7	Million Kcals
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Attachment 6 Thermal Plume Limitations for Thermal Shock

Thermal Plume Limitations within the Mixing Zone Rule (OAR 340-041-0053)
Thermal Shock - 25 deg C at 5% of the stream cross section
Migration Blockage - 21 deg C at 25% of the stream cross section
Section 5.6 of Temperature IMD

Attachment 6			
Facility Name:	Lincoln City	Date:	9/12/2017

Enter data into white cells below:

7Q10 =	<input type="text" value="40"/>	cfs
Ambient Temperature or Criterion =	<input type="text" value="25"/>	°C
Effluent Flow =	<input type="text" value="3"/>	mgd
Max Effluent Temperature =	<input type="text" value="23"/>	°C
7 day Max Effluent Temperature =	<input type="text" value="23.35"/>	°C

5% of 7Q10 =	2.0	cfs
5% dilution =	1	
25% of 7Q10 =	10.0	cfs
25% dilution =	3	dilution = (Qe+Qr)/Qe

Temperature at 5% cross section =	23.60 °C	No Reasonable Potential
Temperature at 25% cross section =	24.48 °C	No Reasonable Potential
ΔT at 25% Stream Flow=	-0.52 °C	

Attachment 6A Thermal Plume Limitations for Migration Blockage

Thermal Plume Limitations within the Mixing Zone Rule (OAR 340-041-0053)
Thermal Shock - 25 deg C at 5% of the stream cross section
Migration Blockage - 21 deg C at 25% of the stream cross section
Section 5.6 of Temperature IMD

		Attachment 6(A)	
Facility Name:	Lincoln City	Date:	9/12/2017

Enter data into white cells below:

7Q10 =	<input type="text" value="40"/>	cfs
Ambient Temperature or Criterion =	<input type="text" value="14.7"/>	°C
Effluent Flow =	<input type="text" value="3"/>	mgd
Max Effluent Temperature =	<input type="text" value="23"/>	°C
7 day Max Effluent Temperature =	<input type="text" value="23.35"/>	°C

5% of 7Q10 =	2.0	cfs
5% dilution =	1	
25% of 7Q10 =	10.0	cfs
25% dilution =	3	dilution = (Qe+Qr)/Qe

Temperature at 5% cross section =	20.50 °C	No Reasonable Potential
Temperature at 25% cross section =	17.44 °C	No Reasonable Potential
ΔT at 25% Stream Flow=	2.74 °C	

Attachment 7 Ammonia

Ammonia RPA Calculation (2013 Criteria) Revision 1.6																
RPA Run Information				Please complete the following General Facility Information												
Facility Name:	Lincoln City			1. Enter Facility Design Flow (MGD)	3			4. If answered "Yes" to Question 2, then fill in dilution factors from mixing zone study								
DEQ File Number:	50677			2. Do I have dilution values from a mixing zone study?	Yes			Dilution @ ZID (from study)	1							
Permit Writer Name:	Robert Dickss			3. If answered "No" to Question 2, then fill in the following table				Dilution @ MZ 7Q10 (from study)	4							
Outfall Number:	1			Stream Flow: 7Q10	CFS	na		Dilution @ MZ 30Q5 (from study)	4							
Date of RPA Run:	2/14/2019			Stream Flow: 30Q5	CFS	na		5. Is the receiving waterbody fresh or salt water?	Fresh							
RPA Run Notes:				Stream Flow: 1Q10	CFS	na		6. If answered "Salt" to Question 5, then enter								
KEY:				% dilution at ZID	%	10%		Ambient Salinity	ppt	na						
* Enter data here	-- Calculated results			% dilution at MZ	%	25%		Effluent Salinity	ppt	na						
				Calculated Dilution Fact.				7. Are Salmonid present? (Yes/No) (Mussels presumed present)	Yes							
				Dilution @ ZID	#VALUE!			8. Please enter statistical Confidence and Probability values (note: defaults already entered)								
				Dilution @ MZ (7Q10)	#VALUE!			Confidence Level	%ile	99%						
				Dilution @ MZ (30Q5)	#VALUE!			Probability Basis	%ile	95%						
Dilution Calculations																
Inputs				Outputs												
				ZID			4Z (7Q10&Z (30Q5)			ZID			MZ (7Q10&MZ (30Q5)			
Dilution Factors				1.0	4.0	4.0	Upstream			6.4	6.4	6.4				
Upstream Characterization							pKa			1.0	1.0	1.0				
Temperature	deg. C	13.9					Total Inorganic Carb			25.8	25.8	25.8				
pH		7.9					Effluent									
Alkalinity	mg/L CaCO ₃	25					pKa			6.4	6.4	6.4				
Effluent Characterization							Ionization Fraction			0.9	0.9	0.9				
Temperature	deg. C	20					Total Inorganic Carb			84.1	84.1	84.1				
pH		7.3					Mixing Zone									
Alkalinity	mg/L CaCO ₃	75					Temperature			deg. C	20.0	15.4	15.4			
* Calculation of pH of a mixture of two flows based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. ** Selection of alkalinity %ile is based on pH of effluent vs ambient.							Alkalinity			mg/L CaCO ₃	75.0	37.5	37.5			
							Total Inorganic Carb			mg/L CaCO ₃	84.1	40.4	40.4			
							pKa				6.4	6.4	6.4			
							pH				7.3	7.5	7.5			
							Salinity				ppt	--	--			
Reasonable Potential Analysis																
Identify Pollutants of Concern						Determine In-Stream Conc.				WQ CRITERIA						
Pollutant Parameter	# of Samples	Highest Effluent Conc.	Coefficient of Variation	Est. Maximum Effluent Conc.	RP at end of pipe?	Ambient Conc.	Max Total Conc. at ZID	Mix Total Conc. at RMZ (7Q10)	Mix Total Conc. at RMZ (30Q5)	Acute CMC	Chronic Calc. (4-day avg.)	Chronic Calc. (7Q10)	Chronic Calc. (30 day avg.)			
		mg/l	Default=0.6	mg/l	(Yes/No)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l			
Ammonia (Freshwater Salmonids)	47	5.3	0.57	6.4	Yes	0.4	6.36	1.89	1.89	12.17	4.56	--	1.8			
Ammonia (Freshwater, Salmonids absent)	--	--	--	--	--	--	--	--	--	--	--	--	--			
Ammonia (Salt Water)	--	--	--	--	--	--	--	--	--	--	--	--	--			
Det. Reasonable Potential																
Is there Reasonable Potential to Exceed? (Yes/No)																
Pollutant Parameter		Acute	Chronic (4 day avg.)	Chronic (7Q10)	Chronic (30 day avg.)											
Ammonia (Freshwater Salmonids)		NO	NO	YES	YES											
Ammonia (Freshwater, Salmonids absent)		--	--	--	--											
Ammonia (Salt Water)		--	--	--	--											
Effluent Limits																
Pollutant Parameter	# of Req's Samples	Waste Load Allocations				Long Term Average				Effluent Limits						
		Acute WLA	Chronic WLA (4 day avg.)	Chronic WLA (7Q10)	Chronic WLA (30Q5)	Acute LTA	Chronic LTA (4 day)	Chronic LTA (7Q10)	Chronic LTA (30Q5)	Min. LTA	Max Daily (MDL)	Monthly (AML)				
	#/month	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	99%	95%				
Ammonia (Freshwater Salmonids)	12	12.2	17.0	--	6.1	4.1	3.3	--	4.8	4.1	12.2	5.3				
Ammonia (Freshwater, Salmonids absent)	--	--	--	--	--	--	--	--	--	--	--	--				
Ammonia (Salt Water)	--	--	--	--	--	--	--	--	--	--	--	--				

*It should be noted that this spreadsheet reflects a slightly simplified calculation approach. In the case where RP is found by a very small margin, the user should request technical assistance for evaluation and use of alternate Effluent Characterization Data.

Attachment 8 Aquatic Toxicity

Aquatic Toxicity RPA

RPA Run Information

Facility Name: Lincoln City
 DEQ File Number: 506777
 Permit Writer Name: Robert Dickis
 Outfall Number: 1
 Date of RPA Run: 8/20/2018

RPA Run Notes: Copper (MGC acquired through BLM, see excel file 01122-RPA-copperBLM-20180810). Data completed by Jeff Navarro

KEY: * Enter data here --- Intermediate calc.s --- Calculated results

Please complete the following General Facility Information

1. Do you have dilution values from a milling zone study? **Y**
 2. Is the receiving waterbody fresh water? (Y/N) **Y**
 3. If answered "No" to question 2, then fill in the following table:
 Effluent Flow Rate: MGD
 Stream Flow: TQ10 CFS
 Stream Flow: TQ10 CFS
 % dilution at MZ: 10%
 % dilution at MZ: 25%
 Calculated dilution Factors
 Dilution @ ZID: n/a
 Dilution @ MZ: n/a

4. If answered "Y" to Question 1, then fill in dilution factors from milling zone study
 Dilution @ ZID (from study): 1.04
 Dilution @ MZ (from study): 3.5
 5. Please enter "water temperature" below to reflect critical conditions (values from 25 to 400 °F)

6. Please enter statistical Confidence and Probability values (note: defaults already entered)

Maximum Effluent Conc. %ile: 95%
 Confidence Level: 95%

Determine Monitoring Reqs.

Pollutant Parameter	RPA Evaluation Required?	# of Samples	Effluent Conc. (µg/l)	Coef. of Variation	Est. Maximum Effluent Conc. (µg/l)	RP at end of pipe? (Yes/No)	Determine In-Stream Concentrations	1-Hour Conc. at RMZ (µg/l)	4 Day Conc. at RMZ (µg/l)	4 Day Potential to Exceed? (Yes/No)	
Arsenic (total inorganic)	Yes	4	0.051	0.60	2.72	No	2.62	0.79	340.0	150.0	NO
Cadmium (total recoverable)	Yes	4	nd	0.60	---	Non-Det	---	---	1.5	---	NO
Cadmium (dissolved)	Yes	4	nd	0.60	---	Non-Det	---	---	0.2	---	---
Chromium (total recoverable)	Yes	4	1.51	0.60	---	No Water Quality Criteria	---	---	---	---	---
Chromium (dissolved)	Yes	4	1.51	0.60	4.83	No	---	---	931.0	53.2	---
Chromium VI (dissolved)	Yes	4	1.51	0.60	4.83	No	---	---	16.0	11.0	---
Copper (total recoverable)	Yes	4	0.60	0.60	---	No	---	---	8.3	7.1	---
Copper (dissolved)	Yes	4	0.60	0.60	---	---	---	---	---	---	---
Iron (total recoverable)	Yes	4	---	0.60	---	---	---	---	#####	---	---
Lead (total recoverable)	Yes	4	0.326	0.60	1.04	No	---	---	29.2	1.5	---
Lead (dissolved)	Yes	4	0.00056	0.60	0.00	No	0.00	0.04	2.4	0.0	NO
Nickel (total recoverable)	Yes	4	1.59	0.60	5.09	No	---	---	237.0	31.7	---
Nickel (dissolved)	Yes	4	1.12	0.60	3.58	No	---	---	13.0	4.6	---
Selenium (total recoverable)	Yes	4	nd	0.60	---	No Water Quality Criteria	---	---	0.9	0.1	---
Selenium (selenate-selenite)	Yes	4	59.7	0.60	151.04	Non-Det	---	---	---	---	---
Silver (total recoverable)	Yes	4	53.7	0.60	151.04	Yes	183.70	54.80	60.5	72.7	YES
Zinc (total recoverable)	Yes	4	ND	0.60	---	No Water Quality Criteria	---	---	22.0	5.2	---
Zinc (dissolved)	Yes	4	ND	0.60	---	Non-Det	---	---	---	---	---
Cyanide (free)	Yes	4	---	0.60	---	---	---	---	---	---	---

Table 2. Effluent Parameters for Selected POTVs

Table 2. Metals (Total as CaCO3)

Use total data for dissolved criteria (µg/l) **Yes**

Pollutant Parameter	Intake Concentration (µg/l)	Max. Total Conc. at ZID (µg/l)	Max. Total Conc. at RMZ (µg/l)	Reasonable Potential to Exceed? (Yes/No)	Additional Information
Arsenic	---	---	---	---	7440382T 0.5
Cadmium	---	---	---	---	7440382D 1.0
Chromium	---	---	---	---	7440393D 0.1
Copper	---	---	---	---	7440473T 0.4
Iron	---	---	---	---	1608583D 2
Lead	---	---	---	---	1606683T 10
Nickel	---	---	---	---	8654029D 2
Selenium	---	---	---	---	7440506D 2
Silver	---	---	---	---	7439995T 100
Zinc	---	---	---	---	7439921T 1.0
Cyanide	---	---	---	---	7439921D 1.0
	---	---	---	---	7439976T 0.0
	---	---	---	---	7440020D 10
	---	---	---	---	7440220D 10
	---	---	---	---	7782492T 10
	---	---	---	---	7782492D 1.0
	---	---	---	---	7440224T 0.1
	---	---	---	---	7440224D 0.1
	---	---	---	---	7440665D 5.0
	---	---	---	---	7440665T 5.0
	---	---	---	---	57125T 5.0
	---	---	---	---	57125F 10

Table 2: Volatile organic compounds									
Table 2: Acid-extractable compounds									
Table 2: Base-neutral compounds									
Table 3: Pesticides & PCBs									
	Yes	3	20	0.60	78.00	No	pH	DatapH	Dat
Aldrin	*	3	nd	0.60	---	---	---	---	---
BHC Gamma (Lindane)	*	3	nd	0.60	---	Non-Det	---	3.0	---
Chlordane	*	3	nd	0.60	---	Non-Det	---	1.0	0.1
Chlorpyrifos	*	3	nd	0.60	---	Non-Det	---	2.4	0.0
Demeton	*	3	nd	0.60	---	Non-Det	---	0.1	0.0
DDT 4,4'	*	3	nd	0.60	---	Non-Det	---	---	0.1
Dieldrin	*	3	nd	0.60	---	Non-Det	---	1.1	0.0
Endosulfan Alpha	*	3	nd	0.60	---	Non-Det	---	0.2	0.1
Endosulfan Beta	*	3	nd	0.60	---	Non-Det	---	0.2	0.1
Endosulfan	*	3	nd	0.60	---	Non-Det	---	0.2	0.1
Endrin	*	3	nd	0.60	---	Non-Det	---	0.1	0.0
Guthion	*	3	nd	0.60	---	Non-Det	---	---	0.0
Heptachlor	*	3	nd	0.60	---	Non-Det	---	---	0.0
Heptachlor Epoxide	*	3	nd	0.60	---	Non-Det	---	0.5	0.0
Malathion	*	3	nd	0.60	---	Non-Det	---	0.5	0.0
Methidathion	*	3	nd	0.60	---	Non-Det	---	---	0.1
Mirex	*	3	nd	0.60	---	Non-Det	---	---	0.0
Parathion	*	3	nd	0.60	---	Non-Det	---	---	0.0
Toxaphene	*	3	nd	0.60	---	Non-Det	---	0.1	0.0
Total PCBs	*	3	nd	0.60	---	Non-Det	---	0.7	0.0
PCB-Aroclor 1016	*	3	nd	0.60	---	Non-Det	---	2.0	0.0
PCB-Aroclor 1221	*	3	nd	---	No Water Quality Criteria	---	---	---	---
PCB-Aroclor 1232	*	3	nd	---	No Water Quality Criteria	---	---	---	---
PCB-Aroclor 1242	*	3	nd	---	No Water Quality Criteria	---	---	---	---
PCB-Aroclor 1248	*	3	nd	---	No Water Quality Criteria	---	---	---	---
PCB-Aroclor 1254	*	3	nd	---	No Water Quality Criteria	---	---	---	---
PCB-Aroclor 1260	*	3	nd	---	No Water Quality Criteria	---	---	---	---
Other parameters with state water quality criteria									
Sulfide Hydrogen Sulfide	*	---	---	0.60	---	---	---	2.0	---
Phosphorus Elemental	*	---	---	0.60	---	---	---	---	---
Tribuflin(TBT)	*	---	---	0.60	---	---	---	0.5	0.1

Table 2: Acid-extractable compounds

Compound	Y	N	3	nd	0.60	Non-Det.	14	15	9578
2-chlorophenol	N		3	nd	0.60	Non-Det.	14	15	9578
2,4-dichlorophenol	N		3	nd	0.60	Non-Det.	23	29	120632
2,4-dimethylphenol	N		3	nd	0.60	Non-Det.	78	85	106679
Methyl-4,6-dinitrophenol	N		3	nd	0.60	Non-Det.	9.2	28	534621
2,4-dinitrophenol	N		3	nd	0.60	Non-Det.	62	530	5286
Pentaachlorophenol	Y		3	nd	0.60	Non-Det.	0.15	0.3	87866
Phenol	N		3	nd	0.60	Non-Det.	9400	86000	108962
2,4,6-trichlorophenol	N		3	nd	0.60	Non-Det.	330	360	96954
2,4,6-trichlorophenol	Y		3	nd	0.60	Non-Det.	0.23	0.24	88062
Table 2: Base-neutral compounds									
Acenaphthene	N		3	nd	0.60	Non-Det.	95	99	83328
Anthracene	N		3	nd	0.60	Non-Det.	2900	4000	120127
Azobenzene	na		3	nd	No Human Health Water Quality Criterion				103333
Benzidine	Y		3	nd	0.60	Non-Det.	2E-05	2E-05	92876
Benzofuran	Y		3	nd	0.60	Non-Det.	0.0013	0.002	56593
Benzofuran	Y		3	nd	0.60	Non-Det.	0.0013	0.002	50226
Benzofuran	Y		3	nd	0.60	Non-Det.	0.0013	0.002	205992
Benzofuran	Y		3	nd	0.60	Non-Det.	0.0013	0.002	207089
Bis(2-chloroethyl)ether	Y		3	nd	0.60	Non-Det.	0.02	0.053	11444
Bis(2-ethylhexyl)phthalate	N		3	nd	0.60	Non-Det.	1200	6500	108601
Butylbenzyl phthalate	N		3	nd	0.60	Non-Det.	0.2	0.22	17817
2-chloronaphthalene	N		3	nd	0.60	Non-Det.	150	160	95687
Chrysene	Y		3	nd	0.60	Non-Det.	150	160	218019
Di-n-butyl phthalate	N		3	nd	0.60	Non-Det.	400	450	84742
Dibenz(a,h)anthracene	Y		3	nd	0.60	Non-Det.	0.0013	0.002	53703
1,2-Dichlorobenzene (O)	N		3	nd	0.60	Non-Det.	110	130	95601
1,3-Dichlorobenzene (m)	N		3	nd	0.60	Non-Det.	80	96	541731
1,4-Dichlorobenzene (p)	N		3	nd	0.60	Non-Det.	16	19	106467
3,3-Dichlorobenzidine	Y		3	nd	0.60	Non-Det.	0.0027	0.003	91941
Dimethyl phthalate	N		3	nd	0.60	Non-Det.	3600	4400	84662
2,4-dinitrotoluene	Y		3	nd	0.60	Non-Det.	84000	1E+05	13113
1,2-diphenylhydrazine	Y	No	3	nd	0.60	Non-Det.	0.084	0.34	12142
Fluoranthene	N		3	nd	0.60	Non-Det.	0.014	0.02	122667
Fluorene	N		3	nd	0.60	Non-Det.	14	14	206440
Hexachlorobenzene	N		3	nd	0.60	Non-Det.	390	530	86737
Hexachlorobutadiene	Y		3	nd	0.60	Non-Det.	3E-05	3E-05	18741
Hexachlorocyclopentadien	N		3	nd	0.60	Non-Det.	0.36	1.8	87683
Hexachloroethane	Y		3	nd	0.60	Non-Det.	30	110	77474
Indeno[1,2,3-cd]pyrene	Y		3	nd	0.60	Non-Det.	0.29	0.33	67721
Isophthalone	N		3	nd	0.60	Non-Det.	0.0013	0.002	193396
Nitrobenzene	N		3	nd	0.60	Non-Det.	27	96	78691
N-nitrosodimethylamine	Y		3	nd	0.60	Non-Det.	14	69	98953
N-nitrosodipropylamine	Y		3	nd	0.60	Non-Det.	0.0007	0.3	62769
N-nitrosodiphenylamine	Y		3	nd	0.60	Non-Det.	0.0046	0.051	62647
Pentaachlorobenzene	N		3	nd	0.60	Non-Det.	0.55	0.6	86306
Pyrene	N		3	nd	0.60	Non-Det.	0.15	0.15	608335
1,2,4-trichlorobenzene	N		3	nd	0.60	Non-Det.	290	400	129000
Tetraachlorobenzene,1,2,4,5	N		3	nd	0.60	Non-Det.	6.4	7	120621
							0.11	0.11	95943

Table 3: Pesticides & PCBs

Chemical Name	Y/N	3	nd	0.60	Non-Det.	5E-06	5E-06	5E-06	309002
Aldrin	Y	3	nd	0.60	Non-Det.	5E-06	5E-06	309002	
BHC-Technical	Y	No	nd	0.60	Non-Det.	0.0014	0.002	608731	
BHC Alpha	Y	3	nd	0.60	Non-Det.	0.0005	5E-04	318646	
BHC Beta	Y	3	nd	0.60	Non-Det.	0.0016	0.002	318657	
BHC-delta	Y	3	nd	No Water Quality Criteria				319668	
BHC Gamma (Lindane)	N	3	nd	0.60	Non-Det.	0.17	0.18	58699	
Chlordane	Y	3	nd	0.60	Non-Det.	8E-05	8E-05	57749	
DDD 4,4'	Y	3	nd	0.60	Non-Det.	3E-05	3E-05	72648	
DDE 4,4'	Y	3	nd	0.60	Non-Det.	2E-05	2E-05	72559	
DDT 4,4'	Y	3	nd	0.60	Non-Det.	2E-05	2E-05	50233	
Dieldrin	Y	3	nd	0.60	Non-Det.	5E-06	5E-06	60871	
Endosulfan Alpha	N	3	nd	0.60	Non-Det.	8.5	8.9	95988	
Endosulfan Beta	N	3	nd	0.60	Non-Det.	8.5	8.9	33216659	
Endosulfan Sulfate	N	3	nd	0.60	Non-Det.	8.5	8.9	1031078	
Endrin	N	3	nd	0.60	Non-Det.	0.024	0.024	72208	
Endrin Aldehyde	N	3	nd	0.60	Non-Det.	0.03	0.03	7428934	
Heptachlor	Y	3	nd	0.60	Non-Det.	8E-06	8E-06	76448	
Heptachlor Epoxide	Y	3	nd	0.60	Non-Det.	4E-06	4E-06	1024573	
Methoxychlor	N	3	nd	0.60	Non-Det.	100	na	72435	
Toxaphene	Y	3	nd	0.60	Non-Det.	3E-05	3E-05	800352	
Total PCBs	Y	No	nd	0.60	Non-Det.	6E-06	6E-06	1336363	
PCB-Aroclor 1016	Y	3	nd	No Water Quality Criteria				1267412	
PCB-Aroclor 1221	Y	3	nd	No Water Quality Criteria				1104282	
PCB-Aroclor 1232	Y	3	nd	No Water Quality Criteria				114165	
PCB-Aroclor 1242	Y	3	nd	No Water Quality Criteria				53463219	
PCB-Aroclor 1248	Y	3	nd	No Water Quality Criteria				12672296	
PCB-Aroclor 1254	Y	3	nd	No Water Quality Criteria				11097681	
PCB-Aroclor 1260	Y	3	nd	No Water Quality Criteria				11096825	
Other parameters with state water quality criteria									
Barium (total recoverable)	N	3	nd	0.60	Non-Det.	1000	na	7440353	
Manganese (total)	N	3	nd	0.60	Non-Det.	withdrawl	100	743985	
Chlorophenogy Herbicide (2,4,5-TPI)	N	3	nd	0.60	Non-Det.	10	na	93721	
Chlorophenogy Herbicide (2,4-D)	N	3	nd	0.60	Non-Det.	100	na	94757	
Dioxin (2,3,7,8-TCDD)	Y	3	nd	0.60	Non-Det.	5E-10	5E-10	1746016	
Nitrosodibutylamine, N	Y	3	nd	0.60	Non-Det.	0.005	0.022	824163	
Nitrosodiphenylamine, N	Y	3	nd	0.60	Non-Det.	0.0008	0.046	55185	
Nitrosopiperidine, N	Y	3	nd	0.60	Non-Det.	0.076	3.4	930652	

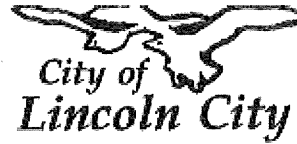
RPA Run Information		General Facility Information	
Facility Name:	Lincoln Cty	1. Do I have dilution values from a mixing zone study? (Y/N)	Y
DEQ File Number:	50677	2. Is the receiving waterbody fresh water? (Y/N)	Y
Permit Writer Name:	Robert Dicksa	3. If answered "N" to Question 1, then fill in the following table	
Outfall Number:	1	Eff. Flow Rate	MGD
Date of RPA Run:	8/20/2018	7Q10	*
RPA Run Notes: Copper IWQC acquired through BLM, see excel file 101122-RPA-copper-BLM-20180810.xlsx completed by Jeff Navarro		CFS	*
		% dilution at ZI	10%
		% dilution at MZ	25%
		Calculated dilution factors	
		Dilution @ ZID	na
		Dilution @ MZ	na
		Effluent	mg/L CaCO ₃ 44
		Up-stream	mg/L CaCO ₃ 60
		ZID boundary	mg/L CaCO ₃ 45
		MZ boundary	mg/L CaCO ₃ 55
		6. Probability basis for WLA multipliers	
		%ile Probability Basis for Calculati	99%
		%ile for Calculating Monthly (AM)	95%
		%ile for Calculating Max Daily (MD)	99%
		4. If answered "Y" to Question 1, then fill in dilution factors from mixing zone study	
		Dilution @ ZID (from study)	1.04
		Dilution @ MZ (from study)	3.5
		5. Hardness Data, Taken from <i>Aquatic Toxicity RPA</i> page	

Pollutant Parameter	Analysis req? (is there a POTW req?)	WQ Criteria	Ambient Conc.	Waste Load Allocations		CV	Monitoring req.	Acute LTA	Chronic LTA	Min. LTA	Effluent Limits	Compliance Limit
				Acute	Chronic							
Table 1: Effluent Parameters for all POTWs w/a Flow > 0.1 MGD Table 2: Metals (total recoverable), cyanide and total phenols												
Arsenic (total inorganic + d)	NO	NO	--	--	--	--	*	--	--	--	--	--
Cadmium (total recoverable)	--	--	--	--	--	--	*	--	--	--	--	--
Cadmium (dissolved)	--	--	--	--	--	--	*	--	--	--	--	--
Chromium III (dissolved)	--	--	--	--	--	--	*	--	--	--	--	--
Chromium VI (dissolved)	--	--	--	--	--	--	*	--	--	--	--	--
Copper (total recoverable)	Y	2,532	0.976	0	2.5	0.6	1	0.8	2.1	0.8	1.50	2.50
Copper (dissolved)	Y	2,532	0.976	0	2.5	0.6	1	0.8	2.1	0.8	1.50	2.50
Iron (total recoverable)	--	--	--	--	--	--	*	--	--	--	--	--
Lead (dissolved)	NO	NO	--	--	--	--	*	--	--	--	--	--
Mercury (total)	NO	NO	--	--	--	--	*	--	--	--	--	--
Nickel (dissolved)	--	--	--	--	--	--	*	--	--	--	--	--
Selenium (selenate+seleni)	--	--	--	--	--	--	*	--	--	--	--	--
Silver (dissolved)	--	--	--	--	--	--	*	--	--	--	--	--
Zinc (dissolved)	YES	60.47	0.3	0.3	63	0.6	1	20	n/a	20	36.28	62.87
Cyanide (free)	--	--	--	--	--	--	*	--	--	--	--	37.10
												64.30

Converted to Total
1.76 3.05

Converted to Total
37.098 64.2889

Attachment 9 Request for Compliance Schedule



Department of
PUBLIC WORKS

December 13th, 2018

DEQ
Western Region-Salem Office
Attn: Robert Dickso
4026 Fairview Industrial Dr. SE
Salem, OR 97302

Re: Request for a copper compliance schedule

Bob,

In light of our meeting with you regarding issuance of our new permit, the City, at this time, would like to request a compliance schedule for the proposed copper limits. The City's facility will not be able to comply with the derived limits and it will take time and modifications to the facility in order to do so.

Sincerely,

Daniel D. Christian
WWTP Supervisor

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DEC 13 2018
DEQ-SALEM OFFICE

Attachment 10 Compliance Schedule Request Response

July 11, 2019

Robert Dicksa
Senior Water Quality Specialist
Permit Specialist
Western Regional Office
Oregon Department of Environmental Quality
4026 Fairview Industrial Drive SE
Salem, OR 97302

Subject: Lincoln City NPDES Permit Renewal – Compliance Schedule Request

Dear Mr. Dicksa,

The City of Lincoln City (City) appreciates the discussions and email communications we have had with you, Steve Schnurbusch, and Ranei Nomura at Oregon Department of Environmental Quality (DEQ) regarding the renewal of our NPDES Permit (# 101122) for the Wastewater Treatment Plant (WWTP). During our last phone call on May 16, 2019 we concluded that the City should request a Compliance Schedule for addressing temperature, bacteria, copper and zinc limits being considered for our permit renewal.

The City requested a Compliance Schedule for copper on December 28, 2019. This letter serves as a Compliance Schedule request for temperature and bacteria. The following are elements for consideration when setting a Compliance Schedule:

1. The City has been and continues to be very proactive operating and maintaining its public works facilities including our Wastewater Treatment Plant (WWTP). Over the past 15 years, we have spent approximately \$27 million in capital improvements. In 2004, the voters approved a \$22 million general obligation bond that matures in 30 years. The purpose of the improvements under this bond was to replace the plant's aeration basins, add capacity to the plant, and replace pump stations that were subject to overflows. The City completed the improvements in 2015.
2. We continue to invest in capital improvements, above the bond amount, approximately \$1 million per year, as follows:

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JUL 18 2019

DEQ-SALEM OFFICE



City of Lincoln City | 801 SW Highway 101 | PO Box 50 | Lincoln City, OR 97137
(503) 996-2154

Public Works Department | lincolncity.org

To ensure equal access to City services, Lincoln City will, as usual, modify procedures for permit applications. Call (503) 996-2154, Oregon Relay (711) or visit the website with request.

- a. Upgrade to collections and wastewater treatment system to improve Inflow/Infiltration,
 - b. Upgrades at the WWTP include over \$4 million on new solids dewatering technology in 2017 to address acute and chronic biosolids management issues and beneficial use limitations here on the Coast. We are also in the process of constructing additional dewatering facilities at a cost of approximately \$600,000.
 - c. Our capital improvement plan over the next ten years will include improvements to 9 sanitary pump station facilities estimated at \$6.5 million; a forcemain and main collector line that contributes to occasional overflows at Nelscott Pump Station, estimated at 6 million.
3. When considering the potential to investment more capital money for something like an ocean outfall to address less than 1.0 degree Celsius of temperature in our effluent, it makes little sense to the City to invest in a new outfall mainly due to:
- a. The Siletz Bay is a very sensitive water body home to a diverse community of fish, shellfish and other aquatic organisms. Even though there are expensive methods of boring outfalls that would help mitigate concerns, our public and environmental organizations would likely be very unsupportive of any disturbance to this ecosystem.
 - b. Although we have not completed a formal engineering evaluation, the cost of an ocean outfall would likely exceed \$15 million.
4. When considering mitigation measures to address dissolved copper requirements in the ug/L concentrations, the City would need to evaluate engineered and non-engineered solutions. Like most facilities improvements, costs would likely be over a million or more. The use of adding more chemicals (e.g., strong alkalis, soluble sulfides, etc.) is also of significant costs.
5. Meeting the proposed bacteria limits will require the City to increase the energy use of our UV disinfection and may, ultimately, require us to consider filtering the effluent to ensure turbidity does not reduce the efficiency of bacteria destruction. The City is already evaluating the operational approach and costs to address the potential bacteria limits but are concerned about the impact to the facility and potential additional costs for facilities.

The above are our initial thoughts and considerations as we contemplate receiving our renewed NPDES permit. The potential costs for implementing these



City of Lincoln City | 801 SW Highway 101 | PO Box 60 | Lincoln City, OR 97137
 503.998.2154 | Public Works Department | lincolncity.org

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proposed requirements are daunting to us and are of huge concern. Moreover, we do not believe planning, designing, constructing, operating and maintaining facilities specific to a single pollutant is reasonable, cost effective or environmentally responsible.

The City, the overall watershed and water quality, Schooner Creek, and ratepayers would benefit from implementing some type of riparian restoration (e.g., tree planting, etc.) to address temperature limits and it would potentially help with addressing bacteria in Schooner Creek. Additionally, it would help keep flow in the Creek by maintaining our effluent discharge.

The City is appreciative of DEQ taking the above in consideration when determining a Compliance Schedule. The City is not supportive of having a "fix" within the next permitting cycle but rather carefully considering our options and implementing mitigation measures over the next decade and beyond.

Sincerely,

Ronald F. Chandler
Ronald F. Chandler, City Manager



City of Lincoln City | 1001 SW Highway 101 | PO Box 90 | Lincoln City, OR 97132
(503) 995-3454

Public Works Department | lincolncity.org

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Water Quality Program

DEQ response to comments

NPDES Permit: LINCOLN CITY

File number: 50677

Permit number: 101122

June 10, 2020

Overview

DEQ accepted public comment on the proposed permit number 101122 from April 30, 2020 through June 4, 2020. This permit originally expired on December 31, 2007, and was administratively continued. This document provides a summary of each comment and a response from DEQ.

The following individuals or entities submitted written comments by mail, email, or provided comments in writing during the public hearing (if held):

List of commenters		
#	Commenter	Affiliation
1	City of Lincoln City	NPDES Permittee

Public comments received by the close of the public comment period are organized by commenter or by topic if more than one comment was made about the same topic. DEQ's response follows the summary comment. Original comments are on file with DEQ.

1. City of Lincoln City (May 21, 2020)

Comment: Schedule B Minimum Monitoring and Reporting Requirements

Table B2, Page 16

Temperature (00010)

There is no need to report daily maximum temperature and the 7-day rolling averages of those maximum temperatures when our Excess Thermal Load (ETL) is not calculated on 7-day rolling averages of temperature and flow. The daily temperatures and flow are used to calculate a daily ETL and then those daily ETL's are reported as a 7-day rolling average.

Total Aluminum (001105)

The City requests clarification on the following: There is a monthly year-round requirement to test for Total Aluminum in Table B2 and a 24-month requirement in the Table B4 Copper Biotic Ligand Model and Aluminum Sampling Requirements. If both requirements are intended, can they both be satisfied with the same sample or are we required to take two monthly Total Aluminum samples for 24 months and then only one thereafter?

Ammonia and Hardness

The City requests the minimum testing frequency for these be change to 2 per week to match the other 24-hour composite samples (influent and effluent, BOD & TSS) that we currently collect. A sampling regime of 3 per week will require extra 24-hour composite samples just for these two analytes. This will be problematic because we need our contract lab to perform these analyses at least initially, (mainly due to the complicated nature of the NH₃-N test and lack of staff experience with it) and then only pick-up samples at noon on Wednesdays in Newport. This means on single malfunction of the effluent sampler will automatically cause a violation or require staff to drive samples to Eugene. It would also require that we start a composite sample on Sunday mornings.



State of Oregon
Department of
Environmental
Quality

Water Quality
permitting program
Western Region
4026 Fairview
Industrial Dr. S.E.
Salem, OR 97302
Phone: 503-378-5055
800-349-7677
Fax: 503-373-7944
Contact: Jennifer
Maglinter-Timbrook

www.oregon.gov/DEQ

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land and water.*

Water Quality Program

Response:

The daily maximum and 7DADM temperature values, while not used for compliance purposes, are needed to characterize the effluent for RPAs (e.g. thermal plumes) during permit renewal. Therefore, these reporting statistics will remain in Table B3 on Page 19, of the permit.

Table B3, Page 19 of the proposed permit has been edited and Total Aluminum monitoring removed from the effluent monitoring requirements. Total Aluminum monitoring remains in Table B4 for copper and aluminum.

The proposed permit has been edited to require ammonia and hardness monitoring at 2 per week as requested.

2. City of Lincoln City (May 21, 2020)

Comment: Schedule D: Special Conditions

Hauled Waste Control Plan

The Lincoln City Wastewater Plant currently accepts septic waste and chemical toilet waste from local haulers. Current draft permit language reads that we cannot accept hauled waste until we have an approved plan. To avoid a disruption in this important service to the community during the time we are drafting the Hauled Waste Control Plan, we request DEQ add language to the permit that allows continued acceptance of waste until a plan is approved.

Response:

The proposed permit has been edited to add language to Schedule D, 7, that allows the permittee to continue to accept hauled waste and a date to submit a written Hauled Waste Control Plan.

3. City of Lincoln City (May 21, 2020)

Comment: Inaccuracies in the Permit Evaluation Report

The following are some errors found during review

4.0 Facility Description

- **Magnesium Oxide is now stored in a 4000-gallon tanks**
- **Effluent flow is not “constant”. The plant is a true batch reactor and should not be confused with “constant flow SBRs”. There are periods in between decants where there is no flow, especially during low flow months.**
- **Chlorine is not added to the plant process water.**

4.5.1 Storage of Sewage Sludge

- **Our aerobic digesters are equipped with mixers and aeration racks, not surface aerators.**
- **Our centrifuge is not portable. It is skid mounted and secured to concrete.**
- **The City does not, “also accept sludge for the City of Depoe Bay into their sludge lagoons”. The City accepted a one-time load of sludge from Depoe Bay into our digester to then be dewatered and hauled to Coffin Butte Landfill for disposal.**

Response:

The Fact Sheet (Permit Evaluation Report) has been edited to correct these inaccuracies.



State of Oregon
Department of
Environmental
Quality

Water Quality
permitting program
Western Region
4026 Fairview
Industrial Dr. S.E.
Salem, OR 97302
Phone: 503-378-5055
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Fax: 503-373-7944
Contact: Jennifer
Maglinte-Timbrook

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quality of Oregon's air,
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Attachment 3

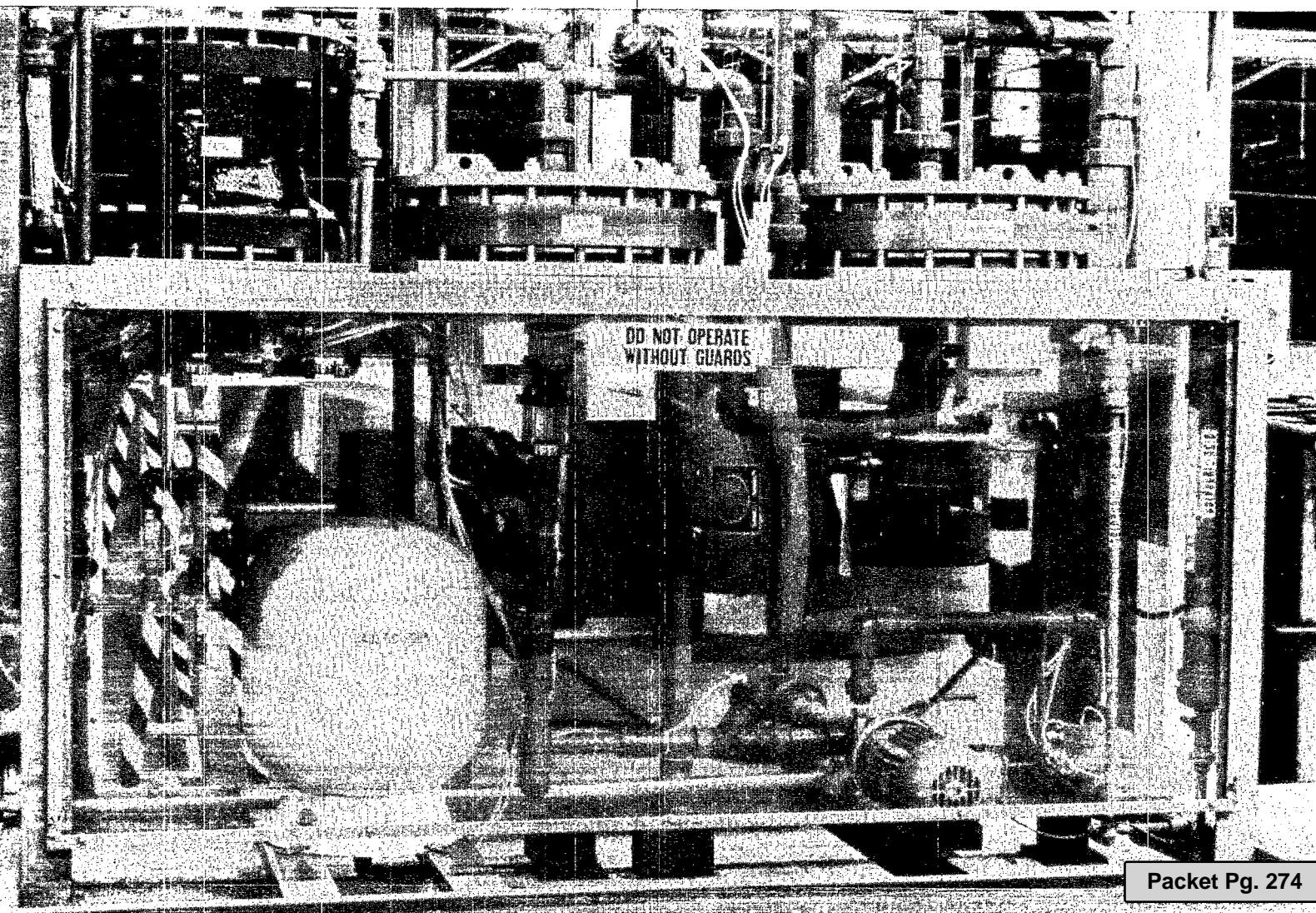
Summary Report - Control and Treatment Technology for the Metal Ion Exchange



Summary Report

Control and Treatment Technology for the Metal Finishing Industry

Ion Exchange



Summary Report

Control and Treatment Technology for the Metal Finishing Industry

Ion Exchange

June 1981

This report was developed by the
Industrial Environmental Research Laboratory
Cincinnati OH 45268

Environmental research and development in the metal finishing industry is the responsibility of the Nonferrous Metals and Minerals Branch, Industrial Environmental Research Laboratory, Cincinnati OH. The U.S. Environmental Protection Agency hired the Centec Corporation, Fort Lauderdale FL and Reston VA, to prepare this report. Roger C. Wilmoth is the EPA Project Officer.

Requests for further information can be addressed to:

Nonferrous Metals and Minerals Branch
IERL-USEPA
Cincinnati OH 45268

EPA thanks the following companies and organizations for providing information and technical review: American Electroplaters' Society; Best Technology, Inc., Villa Park IL; Dow Chemical Company, Midland MI; Institute of Precision Mechanics, Warsaw, Poland; Raytheon Ocean Systems Company, Portsmouth RI; and Rohm and Haas Co., Philadelphia PA.

Photographs were supplied by Best Technology, Inc., of Villa Park IL and Eco-Tec Limited of Toronto ON.

This report has been reviewed by the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati OH, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

COVER PHOTOGRAPH: Reciprocating Flow Ion Exchanger used for chromic acid recovery.

Overview

Ion exchange is a versatile separation process with potential for broad application in the metal finishing industry, both for raw material recovery and reuse and for water pollution control. Three major areas of application have been demonstrated:

- Wastewater purification and recycle
- End-of-pipe pollution control
- Chemical recovery

Although the ion exchange process has been commercially available for many years, widespread interest in its use for metal finishing pollution control has developed only recently.

The main impetus for the interest in ion exchange technology is the broad range of resins manufactured today. With proper resin selection, ion exchange can provide an effective and economical solution to pollution control requirements. As a further stimulus to the use of the process, the metal-bearing sludge generated by hydroxide treatment systems is considered a hazardous material and must be disposed of in an environmentally safe manner. The ion exchange process can concentrate the heavy metals in a dilute wastewater into a concentrated metal solution that is more amenable to metal recovery than is a sludge, and this ability should lead to more widespread use of the technology.

This summary report is intended to promote an understanding of the use of ion exchange in the metal finishing industry. The sections that follow discuss ion exchange process theory in general and evaluate each of the three major areas of application in terms of performance, state of development, cost (in 1980 dollars), and operating reliability.

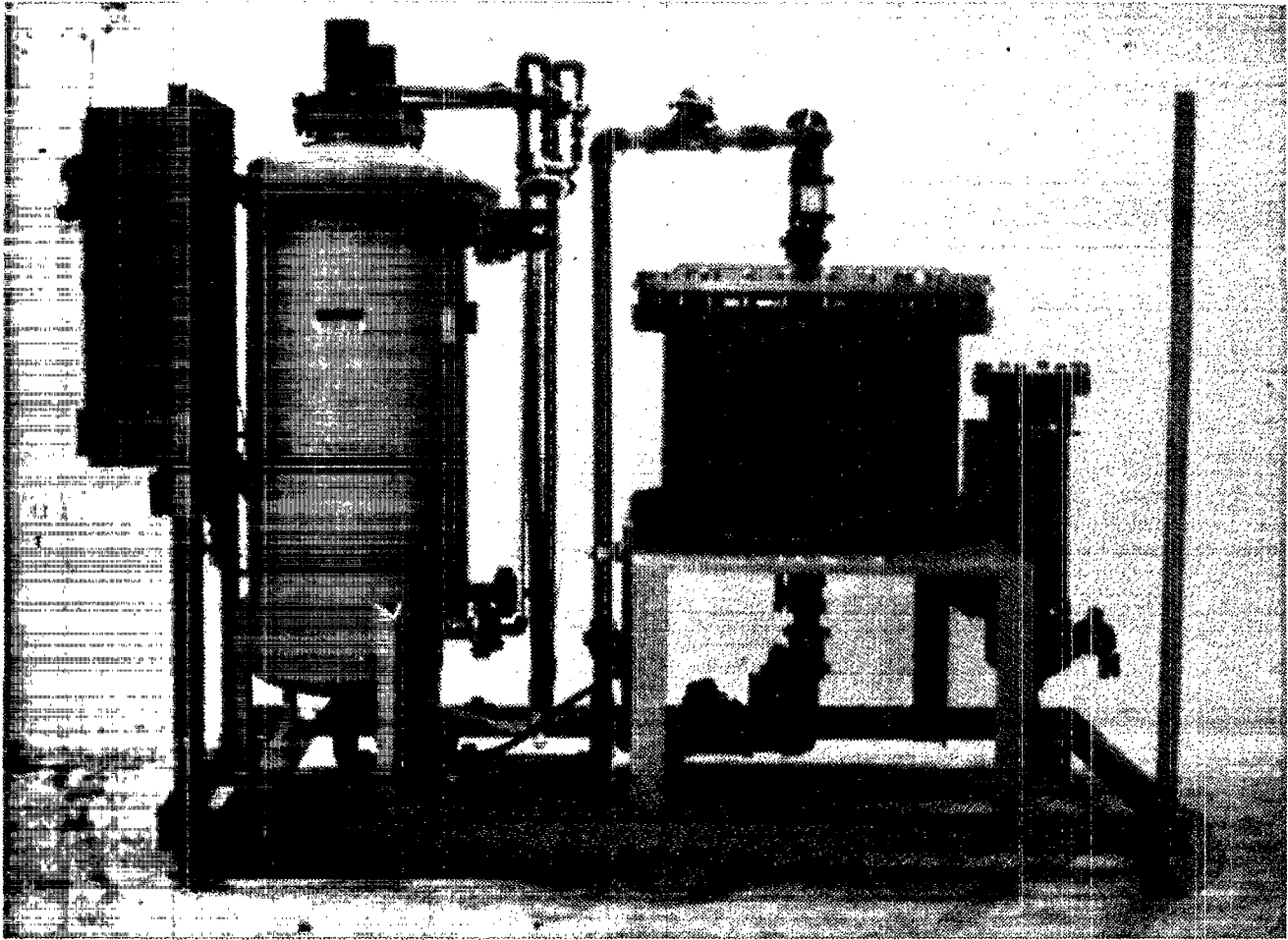
Water Purification and Recycle

In the first area of application, mixed rinse solutions are deionized to permit reuse of the treated water. The contaminants in the rinses are concentrated in the small volume purge streams, and are thereby made more economical to treat.

Because ion exchange is efficient in removing dissolved solids from normally dilute spent rinse waters, it is well suited for use in water purification and recycle. Most of the plating chemicals, acids, and bases used in metal finishing are ionized in water solutions and can be removed by ion exchange. Several factors make the ion exchange process effective for this application:

- Ion exchange can economically separate dilute concentrations of ionic compounds from water solutions.
- The process can consistently provide high purity water over a broad range of loading conditions.
- The resins used for separation are durable in severe chemical environments.

Application of the ion exchange process in a wastewater purification and recycle system will significantly reduce water consumption and the volume of wastewater discharged, thus reducing water use and sewer fees and the size and cost of the pollution control system. Also, for plants that discharge wastewater directly to waterways and that are regulated by mass-based pollutant discharge limits, the reduction of discharge volume will allow for higher concentrations of pollutants in the discharge and facilitate compliance with these limits.



Ion exchange acid purification unit used for sulfuric acid anodizing solutions

End-of-Pipe Pollution Control

In the second application, toxic heavy metals and metal cyanide complexes are removed selectively from combined waste streams before discharge. The key to this application is that the ion exchange resins remove only the toxic compounds and allow the nontoxic dissolved ionic solids to remain in solution.

The ion exchange process can be used in two different forms for end-of-pipe pollution control: it has been demonstrated as a means of polishing the effluent from

conventional hydroxide precipitation to lower the metal concentration in the discharge; it has also been applied as a means of directly treating wastewaters to remove heavy metal and metal cyanide pollutants.

Most plating shops can remove sufficient metal to comply with wastewater discharge regulations using the conventional hydroxide precipitation process. Where unusually strict limits are placed on the effluent metal concentration, however, or where the metals are complexed with chemical constituents that interfere with their precipitation as metal hydroxides, conventional treatment may not be reliable for compliance with

the discharge limits. Ion exchange can be used in such cases to polish the effluent from the conventional treatment and reduce the metal concentration further. In this application, the process can provide a relatively inexpensive means of upgrading system performance for compliance with the discharge regulations.

Ion exchange has been used to a limited extent to remove toxic pollutants selectively from an untreated wastewater while allowing most of the nontoxic ions to pass through. Approaches employed to facil-

itate this application include using:

- Weak acid cation resin in an application of the wastewater-softening type to remove heavy metals and other divalent cations from a wastewater solution with a high concentration of sodium ions
- Heavy-metal-selective weak acid or chelating cation resin to remove only the heavy metal ions while allowing sodium, calcium, and magnesium ions to pass through
- A stratified bed of resin containing strong and weak acid cation and strong base anion resins to remove heavy metal and metal cyanide complex ions from solution while allowing most of the wastewater ionic constituents to pass through

In each of these approaches, wastewater pretreatment entails pH adjustment, to ensure that pH is within the operating range of the resin, and filtration, to remove suspended solids that would foul the resin bed. The pollutants removed from the wastewater are concentrated in the ion exchange regenerant solutions. The regenerants can be treated in a small batch treatment system using conventional processes. Firms with access to a centralized treatment system to

dispose of the regenerant solutions resulting from treatment would not need to install chemical destruct systems. In neither case would it be necessary to invest in sophisticated pH control systems, flocculant feed systems, clarifiers, and other process equipment associated with conventional metal precipitation systems. And, as a further advantage, ion exchange units are compact and easy to automate compared with conventional precipitation systems.

Chemical Recovery

In the chemical recovery application, segregated plating rinse waters are treated to concentrate the plating chemicals for recycle to the plating bath. The purified rinse water is also recycled.

Ion exchange, evaporation, reverse osmosis, and electro dialysis have all been used in the plating industry to recover chemicals from rinse solutions. These processes have in common the ability to separate specific compounds from a water solution, yielding a concentrate of those compounds and relatively pure water. The concentrate is recycled to the plating

bath and the purified water is reused for rinsing. Determination of the separation process best suited for a particular chemical recovery application usually requires evaluating both general and site-specific factors:

- General factors include rinse water concentration, volume, and corrosivity, among others.
- Site-specific factors include, for example, availability of floor space and utilities (steam, chemical reagents, electricity, and so forth) and the degree of concentration needed to recycle the chemicals to the bath.

As a rule, ion exchange systems are suitable for chemical recovery applications where the rinse water feed has a relatively dilute concentration of plating chemicals and a relatively low degree of concentration is required for recycle of the concentrate. Ion exchange is well suited for processing corrosive solutions. Ion exchange has been demonstrated commercially for recovery of plating chemicals from acid-copper, acid-zinc, nickel, tin, cobalt, and chromium plating baths. The process has also been used to recover spent acid solutions and to purify plating solutions for longer service life.

Basic Concepts

Ion Exchange Reactions

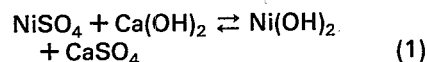
Ion exchange is a reversible chemical reaction wherein an ion (an atom or molecule that has lost or gained an electron and thus acquired an electrical charge) from solution is exchanged for a similarly charged ion attached to an immobile solid particle. These solid ion exchange particles are either naturally occurring inorganic zeolites or synthetically produced organic resins. The synthetic organic resins are the predominant type used today because their characteristics can be tailored to specific applications.

An organic ion exchange resin is composed of high-molecular-weight polyelectrolytes that can exchange their mobile ions for ions of similar charge from the surrounding medium. Each resin has a distinct number of mobile ion sites that set the maximum quantity of exchanges per unit of resin.

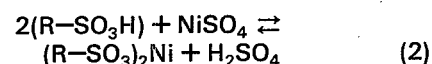
Most plating process water is used to cleanse the surface of the parts after each process bath. To maintain quality standards, the level of dissolved solids in the rinse water must be regulated. Fresh water added to the rinse tank accomplishes this purpose, and the overflow water is treated to remove pollutants and then discharged. As the metal salts, acids, and bases used in metal finishing are primarily inorganic compounds, they are ionized in water and could be removed by contact with ion exchange resins. In a water deionization process, the resins exchange hydrogen ions (H^+) for the positively charged ions (such as nickel, copper, and sodium), and hydroxyl ions (OH^-) for negatively charged sulfates, chromates, and chlorides. Because the quantity of H^+ and OH^- ions is balanced, the result of the ion exchange treatment is relatively pure, neutral water.

Ion exchange reactions are stoichiometric and reversible, and in that way they are similar to other

solution phase reactions. For example:

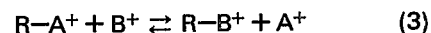


In this reaction, the nickel ions of the nickel sulfate ($NiSO_4$) are exchanged for the calcium ions of the calcium hydroxide [$Ca(OH)_2$] molecule. Similarly, a resin with hydrogen ions available for exchange will exchange those ions for nickel ions from solution. The reaction can be written as follows:



R indicates the organic portion of the resin and SO_3 is the immobile portion of the ion active group. Two resin sites are needed for nickel ions with a plus 2 valence (Ni^{+2}). Trivalent ferric ions would require three resin sites.

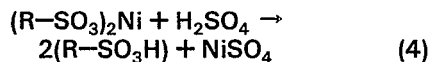
As shown, the ion exchange reaction is reversible. The degree the reaction proceeds to the right will depend on the resin's preference, or selectivity, for nickel ions compared with its preference for hydrogen ions. The selectivity of a resin for a given ion is measured by the selectivity coefficient, K, which in its simplest form for the reaction



is expressed as: $K = (\text{concentration of } B^+ \text{ in resin} / \text{concentration of } A^+ \text{ in resin}) \times (\text{concentration of } A^+ \text{ in solution} / \text{concentration of } B^+ \text{ in solution})$.

The selectivity coefficient expresses the relative distribution of the ions when a resin in the A^+ form is placed in a solution containing B^+ ions. Table 1 gives the selectivities of strong acid and strong base ion exchange resins for various ionic compounds. It should be pointed out that the selectivity coefficient is not constant but varies with changes in solution conditions. It does provide a means of determining what to expect when various ions

are involved. As indicated in Table 1, strong acid resins have a preference for nickel over hydrogen. Despite this preference, the resin can be converted back to the hydrogen form by contact with a concentrated solution of sulfuric acid (H₂SO₄):



This step is known as regeneration. In general terms, the higher the preference a resin exhibits for a particular ion, the greater the exchange efficiency in terms of resin capacity for removal of that ion from solution. Greater preference for a particular ion, however, will result in increased consumption of chemicals for regeneration.

Resins currently available exhibit a range of selectivities and thus have broad application. As an example, for a strong acid resin, the relative preference for divalent calcium ions (Ca⁺²) over divalent copper ions (Cu⁺²) is approximately 1.5 to 1. For a heavy-metal-selective resin, the preference is reversed and favors copper by a ratio of 2,300 to 1.

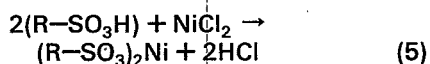
Table 1.
Selectivity of Ion Exchange Resins,
in Order of Decreasing Preference

Strong acid cation exchanger	Strong base anion exchanger
Barium	Iodide
Lead	Nitrate
Calcium	Bisulfite
Nickel	Chloride
Cadmium	Cyanide
Copper	Bicarbonate
Zinc	Hydroxide
Magnesium	Fluoride
Potassium	Sulfate
Ammonia	
Sodium	
Hydrogen	

Resin Types

Ion exchange resins are classified as cation exchangers, which have positively charged mobile ions available for exchange, and anion exchangers, whose exchangeable ions are negatively charged. Both anion and cation resins are produced from the same basic organic polymers. They differ in the ionizable group attached to the hydrocarbon network. It is this functional group that determines the chemical behavior of the resin. Resins can be broadly classified as strong or weak acid cation exchangers or strong or weak base anion exchangers.

Strong Acid Cation Resins. Strong acid resins are so named because their chemical behavior is similar to that of a strong acid. The resins are highly ionized in both the acid (R-SO₃H) and salt (R-SO₃Na) form. They can convert a metal salt to the corresponding acid by the reaction:



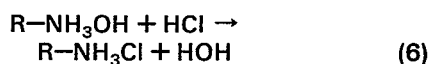
The hydrogen and sodium forms of strong acid resins are highly dissociated and the exchangeable Na⁺ and H⁺ are readily available for exchange over the entire pH range. Consequently, the exchange capacity of strong acid resins is independent of solution pH. These resins would be used in the hydrogen form for complete deionization; they are used in the sodium form for water softening (calcium and magnesium removal). After exhaustion, the resin is converted back to the hydrogen form (regenerated) by contact with a strong acid solution, or the resin can be converted to the sodium form with a sodium chloride solution. For Equation 5, hydrochloric acid (HCl) regeneration would result in a concentrated nickel chloride (NiCl₂) solution.

Weak Acid Cation Resins. In a weak acid resin, the ionizable group is a carboxylic acid (COOH) as opposed

to the sulfonic acid group (SO₃H) used in strong acid resins. These resins behave similarly to weak organic acids that are weakly dissociated.

Weak acid resins exhibit a much higher affinity for hydrogen ions than do strong acid resins. This characteristic allows for regeneration to the hydrogen form with significantly less acid than is required for strong acid resins. Almost complete regeneration can be accomplished with stoichiometric amounts of acid. The degree of dissociation of a weak acid resin is strongly influenced by the solution pH. Consequently, resin capacity depends in part on solution pH. Figure 1 shows that a typical weak acid resin has limited capacity below a pH of 6.0, making it unsuitable for deionizing acidic metal finishing wastewater.

Strong Base Anion Resins. Like strong acid resins, strong base resins are highly ionized and can be used over the entire pH range. These resins are used in the hydroxide (OH) form for water deionization. They will react with anions in solution and can convert an acid solution to pure water:



Regeneration with concentrated sodium hydroxide (NaOH) converts the exhausted resin to the hydroxide form.

Weak Base Anion Resins. Weak base resins are like weak acid resins, in that the degree of ionization is strongly influenced by pH. Consequently, weak base resins exhibit minimum exchange capacity above a pH of 7.0 (Figure 1). These resins merely sorb strong acids; they cannot split salts.

In an ion exchange wastewater deionization unit, the wastewater would pass first through a bed of

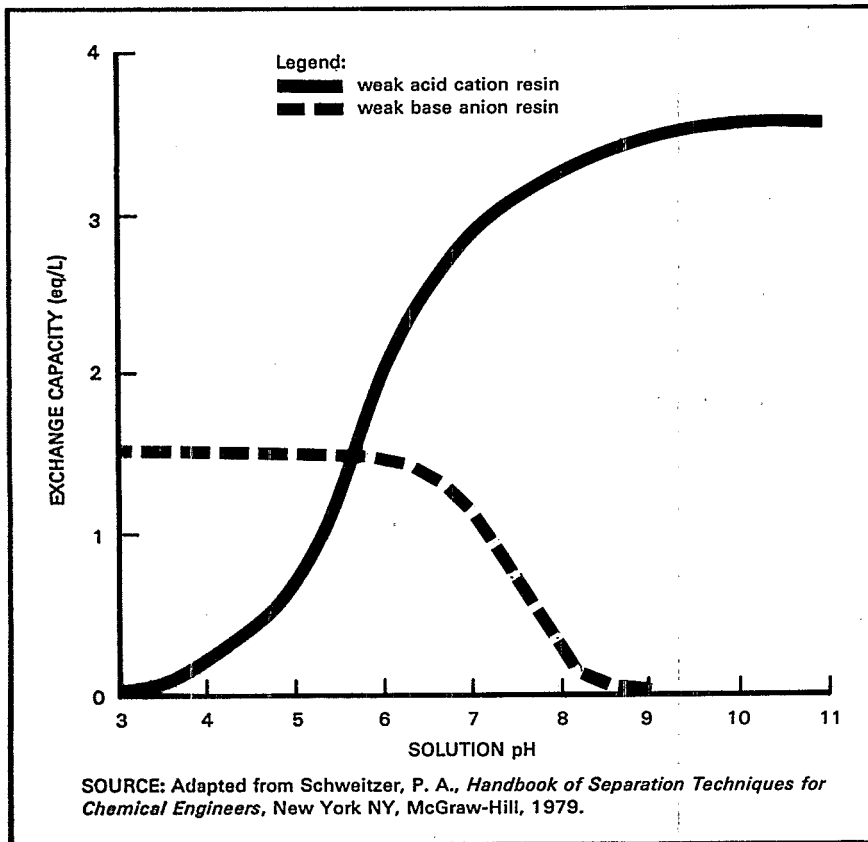
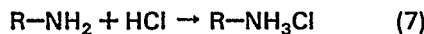


Figure 1.

Exchange Capacity of Weak Acid Cation and Weak Base Anion Resins as a Function of Solution pH

strong acid resin. Replacement of the metal cations (Ni^{+2} , Cu^{+2}) with hydrogen ions would lower the solution pH. The anions (SO_4^{-2} , Cl^-) can then be removed with a weak base resin because the entering wastewater will normally be acidic and weak base resins sorb acids. Weak base resins are preferred over strong base resins because they require less regenerant chemical. A reaction between the resin in the free base form and HCl would proceed as follows:



The weak base resin does not have a hydroxide ion form as does the strong base resin. Consequently, regeneration needs only to neutralize the absorbed acid; it need not

provide hydroxide ions. Less expensive weakly basic reagents such as ammonia (NH_3) or sodium carbonate can be employed.

Heavy-Metal-Selective Chelating Resins. Chelating resins behave similarly to weak acid cation resins but exhibit a high degree of selectivity for heavy metal cations. Chelating resins are analogous to chelating compounds found in metal finishing wastewater; that is, they tend to form stable complexes with the heavy metals. In fact, the functional group used in these resins is an EDTA^a compound. The resin structure in the sodium form is expressed as R-EDTA-Na.

^aEthylenediaminetetraacetic acid.

The high degree of selectivity for heavy metals permits separation of these ionic compounds from solutions containing high background levels of calcium, magnesium, and sodium ions. A chelating resin exhibits greater selectivity for heavy metals in its sodium form than in its hydrogen form. Regeneration properties are similar to those of a weak acid resin; the chelating resin can be converted to the hydrogen form with slightly greater than stoichiometric doses of acid because of the fortunate tendency of the heavy metal complex to become less stable under low pH conditions. Potential applications of the chelating resin include polishing to lower the heavy metal concentration in the effluent from a hydroxide treatment process, or directly removing toxic heavy metal cations from wastewaters containing a high concentration of nontoxic, multivalent cations.

Table 2 shows the preference of a commercially available chelating resin for heavy metal cations over calcium ions. (The chelating resins exhibit a similar magnitude of selectivity for heavy metals over sodium or magnesium ions.) The selectivity coefficient defines the relative preference the resin exhibits for different ions. The preference for copper (shown in Table 2) is 2,300 times that

Table 2.

Chelating Cation Resin Selectivities for Metal Ions

Metal ion	K^M/Ca^a
Hg ⁺²	2,800
Cu ⁺²	2,300
Pb ⁺²	1,200
Ni ⁺²	57
Zn ⁺²	17
Cd ⁺²	15
Co ⁺²	6.7
Fe ⁺²	4
Mn ⁺²	1.2
Ca ⁺²	1

^aSelectivity coefficient for the metal over calcium ions at a pH of 4.

for calcium. Therefore, when a solution is treated that contains equal molar concentrations of copper and calcium ions, at equilibrium, the molar concentration of copper ions on the resin will be 2,300 times the concentration of calcium ions. Or, when solution is treated that contains a calcium ion molar concentration 2,300 times that of the copper ion concentration, at equilibrium, the resin would hold an equal concentration of copper and calcium.

Their high cost is the disadvantage of using the heavy-metal-selective chelating resins. Table 3 compares the cost of these with the

Table 3.

Cost of Commercially Available Resins

Resin	Cost (\$/ft ³)
Strong acid cation.....	50-100
Weak acid cation.....	100-150
Strong base anion.....	150-200
Weak base anion.....	150-200
Chelating cation.....	200-300

Note.—1980 dollars.

costs of the other commercially available resins.

Batch and Column Exchange Systems

Ion exchange processing can be accomplished by either a batch method or a column method. In the first method, the resin and solution are mixed in a batch tank, the exchange is allowed to come to equilibrium, then the resin is separated from solution. The degree to which the exchange takes place is limited by the preference the resin exhibits for the ion in solution. Consequently, the use of the resin's exchange capacity will be limited unless the selectivity for the ion in solution is far greater than for the exchangeable ion attached to the resin. Because batch regeneration of the resin is chemically inefficient, batch processing by ion exchange has limited potential for application.

Passing a solution through a column containing a bed of exchange resin is analogous to treating the solution in an infinite series of batch tanks. Consider a series of

tanks each containing 1 equivalent (eq) of resin in the X ion form (see Figure 2). A volume of solution containing 1 eq of Y ions is charged into the first tank. Assuming the resin to have an equal preference for ions X and Y, when equilibrium is reached the solution phase will contain 0.5 eq of X and Y. Similarly, the resin phase will contain 0.5 eq of X and Y. This separation is the equivalent of that achieved in a batch process.

If the solution were removed from Tank 1 and added to Tank 2, which also contained 1 eq of resin in the X ion form, the solution and resin phase would both contain 0.25 eq of Y ion and 0.75 eq of X ion. Repeating the procedure in a third and fourth tank would reduce the solution content of Y ions to 0.125 and 0.0625 eq, respectively. Despite an unfavorable resin preference, using a sufficient number of stages could reduce the concentration of Y ions in solution to any level desired.

This analysis simplifies the column technique, but it does provide insights into the process dynamics. Separations are possible despite

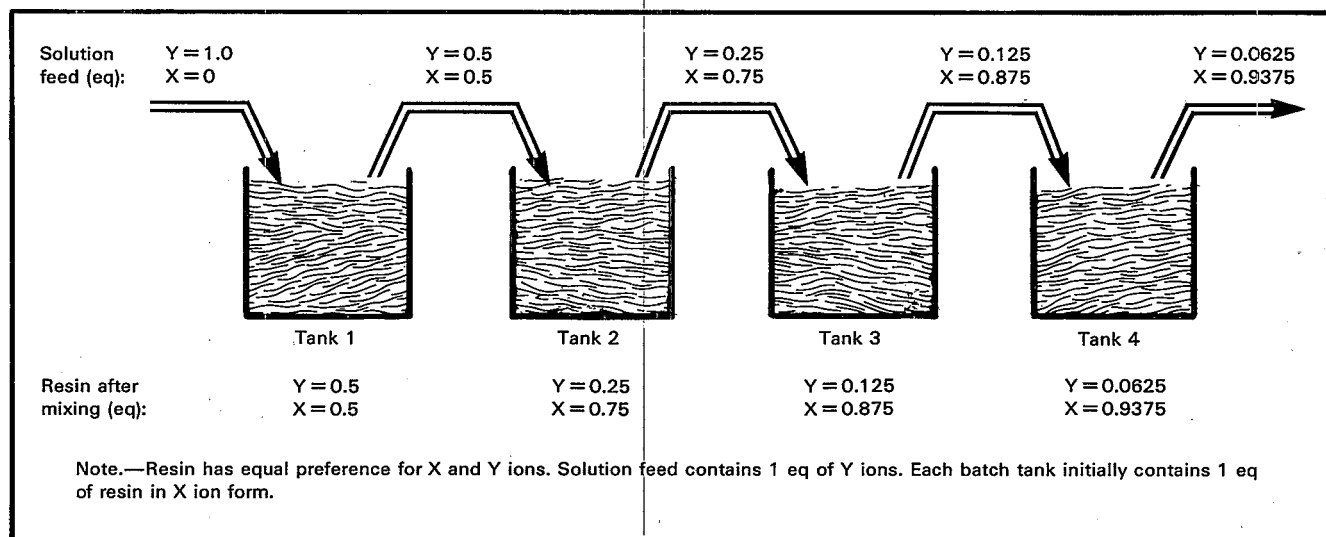


Figure 2.

Concentration Profile in a Series of Ion Exchange Batch Tanks

poor selectivity for the ion being removed.

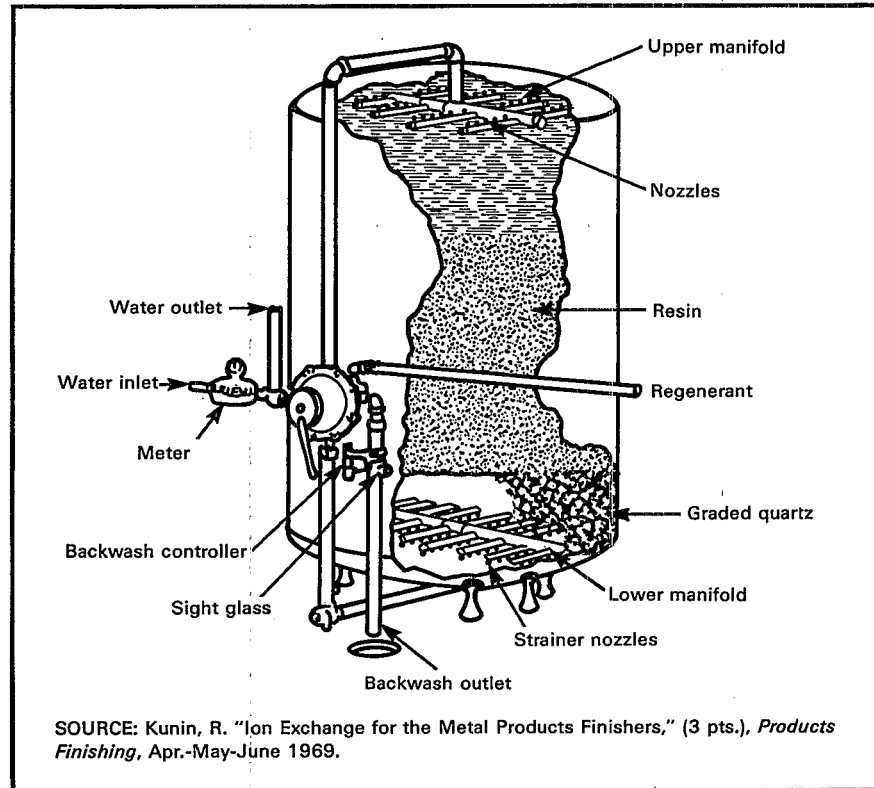
Ion Exchange Process Equipment and Operation

Most industrial applications of ion exchange use fixed-bed column systems, the basic component of which is the resin column (Figure 3). The column design must:

- Contain and support the ion exchange resin
- Uniformly distribute the service and regeneration flow through the resin bed
- Provide space to fluidize the resin during backwash
- Include the piping, valves, and instruments needed to regulate flow of feed, regenerant, and backwash solutions

Regeneration Procedure. After the feed solution is processed to the extent that the resin becomes exhausted and cannot accomplish any further ion exchange, the resin must be regenerated. In normal column operation, for a cation system being converted first to the hydrogen then to the sodium form, regeneration employs the following basic steps:

1. The column is backwashed to remove suspended solids collected by the bed during the service cycle and to eliminate channels that may have formed during this cycle. The backwash flow fluidizes the bed, releases trapped particles, and reorients the resin particles according to size. During backwash the larger, denser particles will accumulate at the base and the particle size will decrease moving up the column. This distribution yields a good hydraulic flow pattern and resistance to fouling by suspended solids.
2. The resin bed is brought in contact with the regenerant solution. In the case of the cation resin, acid elutes the collected ions and converts the bed to the hydro-



SOURCE: Kunin, R. "Ion Exchange for the Metal Products Finishers," (3 pts.), *Products Finishing*, Apr.-May-June 1969.

Figure 3.

Typical Ion Exchange Resin Column

3. The bed is brought in contact with a sodium hydroxide solution to convert the resin to the sodium form. Again, a slow water rinse is used to remove residual caustic. The slow rinse pushes the last of the regenerant through the column.
4. The resin bed is subjected to a fast rinse that removes the last traces of the regenerant solution and ensures good flow characteristics.
5. The column is returned to service.

For resins that experience significant swelling or shrinkage during regeneration, a second backwash should be performed after regeneration to eliminate channeling or resin compression.

gen form. A slow water rinse then removes any residual acid.

Regeneration of a fixed-bed column usually requires between 1 and 2 h. Frequency depends on the volume of resin in the exchange columns and the quantity of heavy metals and other ionized compounds in the wastewater.

Resin capacity is usually expressed in terms of equivalents per liter (eq/L) of resin. An equivalent is the molecular weight in grams of the compound divided by its electrical charge, or valence. For example, a resin with an exchange capacity of 1 eq/L could remove 37.5 g of divalent zinc (Zn^{+2} , molecular weight of 65) from solution. Much of the experience with ion exchange has been in the field of water softening; therefore, capacities will frequently be expressed in terms of kilograins of calcium carbonate per cubic foot of resin. This unit can be converted to equivalents per

liter by multiplying by 0.0458. Typical capacities for commercially available cation and anion resins are shown in Figure 4. The capacities are strongly influenced by the quantity of acid or base used to regenerate the resin. Weak acid and weak base systems are more efficiently regenerated; their capacity increases almost linearly with regenerant dose.

Cocurrent and Countercurrent Regeneration. Columns are designed to use either cocurrent or countercurrent regeneration. In cocurrent units, both feed and regenerant solutions make contact with the resin in a downflow mode. These units are the less expensive of the two in terms of initial equipment cost. On the other hand, cocurrent flow uses regenerant chemicals less efficiently than countercurrent flow; it has higher leakage concentrations (the concentration of the feed solution ion being removed in the column effluent), and cannot achieve as high a product concentration in the regenerant.

Efficient use of regenerant chemicals is primarily a concern with strong acid or strong base resins. The weakly ionized resins require only slightly greater than stoichiometric chemical doses for complete regeneration regardless of whether cocurrent or countercurrent flow is used.

Regenerant Reuse. With strong acid or strong base resin systems, improved chemical efficiency can be achieved by reusing a part of the spent regenerants. In strongly ionized resin systems, the degree of column regeneration is the major factor in determining the chemical efficiency of the regeneration process. (See Figure 5.) To realize 42 percent of the resin's theoretical exchange capacity requires 1.4 times the stoichiometric amount of reagent [2 lb HCl/ft³ (32 g HCl/L)]. To increase the exchange capacity available to 60 percent of theoretical

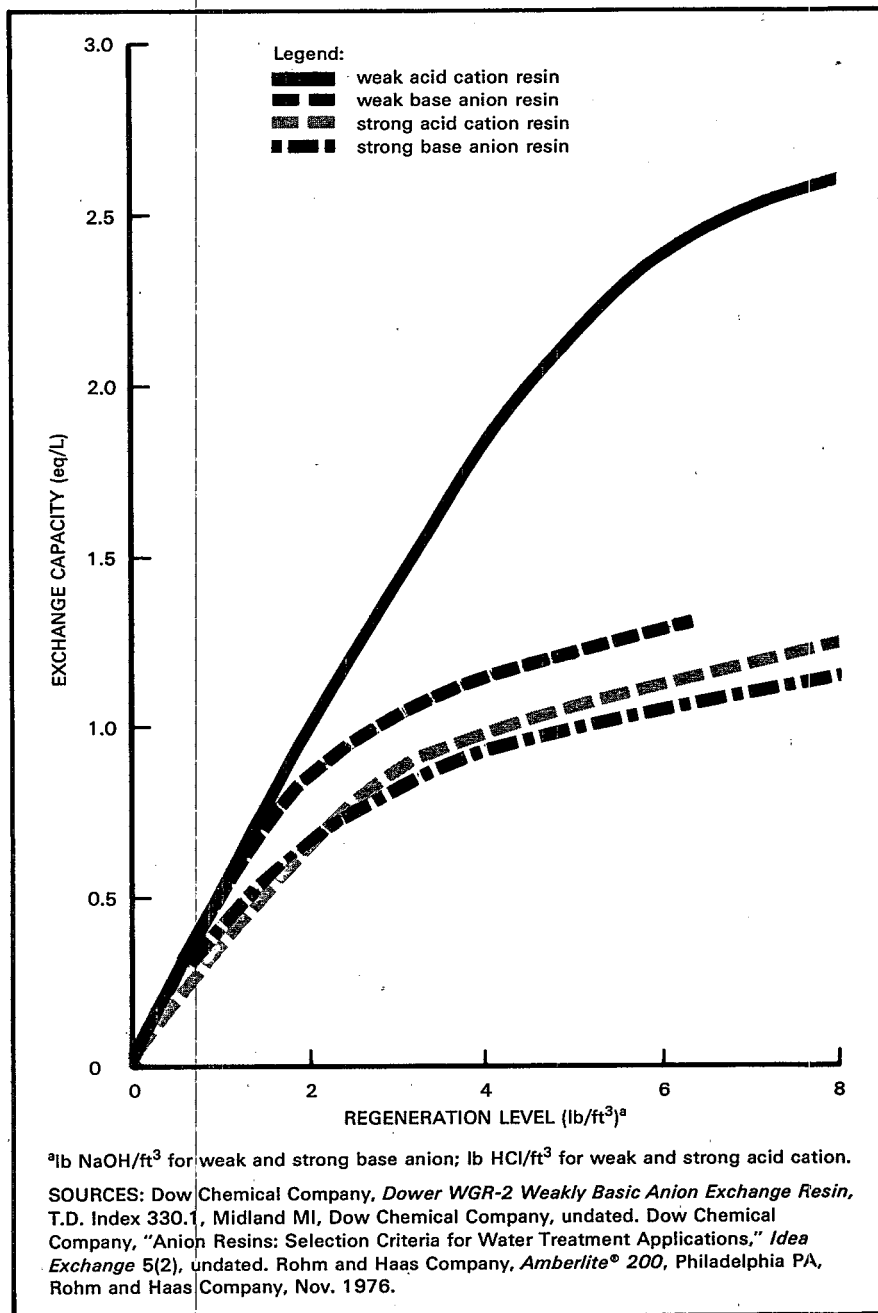


Figure 4.
Resin Exchange Capacities

increases consumption to 2.45 times the stoichiometric dose [5 lb HCl/ft³ (80 g HCl/L)].

The need for acid doses considerably higher than stoichiometric means that there is a significant concentra-

tion of acid in the spent regenerant. Further, as the acid dose is increased incrementally, the concentration of acid in the spent regenerant increases. By discarding only the first part of the spent

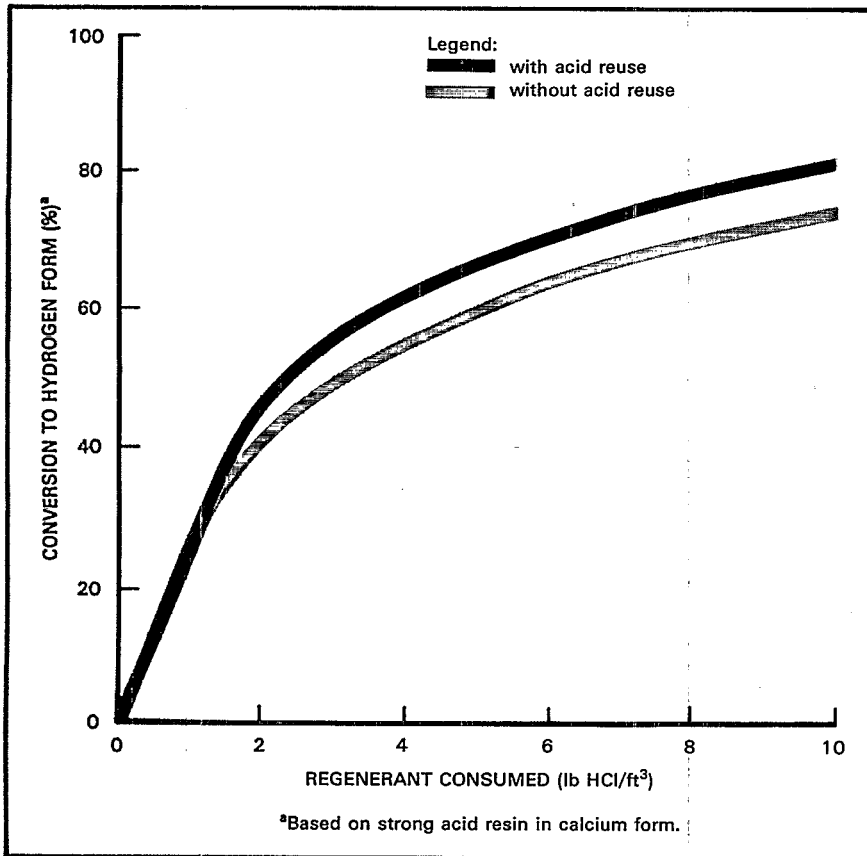


Figure 5.
Effect of Reusing Acid Regenerant on Chemical Efficiency

regenerant and saving and reusing the rest, greater exchange capacity can be realized with equal levels of regenerant consumption. For example, if a regenerant dose of 5 lb HCl/ft³ (80 g HCl/L) were used in the resin system in Figure 5, the first 50 percent of spent regenerant would contain only 29 percent of the original acid concentration. The rest of the acid regenerant would contain 78 percent of the original acid concentration. If this second part of the regenerant is reused in the next regeneration cycle before the resin bed makes contact with 5 lb/ft³ (80 g/L) of fresh HCl, the exchange capacity would increase to 67 percent of theoretical capacity. The available capacity would then increase from 60 to 67 percent at equal chemical doses. Figure 5 shows the improved reagent utilization achieved by this manner of reuse over a range of regenerant doses.

Regenerant reuse has disadvantages in that it is higher in initial cost for chemical storage and feed systems and regeneration procedure is more complicated. Still, where the chemical savings have provided justification, systems have been designed to reuse parts of the spent regenerant as many as five times before discarding them.

Wastewater Recycle Systems

In usual practice, metal finishing wastewater is treated and then discharged to a river or sewer system; as an alternative, the wastewater can be deionized by ion exchange and reused in the plating process. Wastewater deionization will significantly reduce water consumption and the volume of wastewater requiring treatment, with the following primary economic advantages:

- Water use and sewer fees are reduced.
- Although treatment of pollutants is not eliminated, the size and cost of the pollution control system is significantly reduced.

The volume reduction resulting from wastewater recycling can also make pollution discharge limits easier to achieve. For plants discharging wastewater to municipal treatment systems, the national pretreatment standards call for more lenient discharge limits if a plant discharges less than 10,000 gal/d (37,000 L/d). Plants discharging directly to surface waters are typically regulated by mass-based pollutant discharge limits. When translated to a concentration limit based on a volume of discharge, these limits may be difficult to achieve by conventional pollutant removal systems. The reduction of discharge volumes resulting from water recycle will allow for higher concentrations of pollutants in the discharge.

Inorganic plating chemicals such as acids, bases, and metal salts are ionized in water solutions and can be removed from process waters by ion exchange. Some dissolved organic compounds, oils, and free chlorine are typically present in mixed wastewaters and their presence constitutes a potential for fouling or deterioration of the ion exchange resin. Electroplating facilities using ion exchange on mixed wastewaters have found the resins to be operable and stable, however, when the recycle system

incorporates wastewater pretreatment to remove constituents that degrade the resins. When ion exchange is used to remove chromate and zinc from cooling tower blowdown there is similar potential for resin deterioration. Nevertheless, the effects have not been found severe enough to preclude the successful use of ion exchange for this application.

Hexavalent chromium (Cr^{+6}) can be removed if the mixed wastewater is passed through an anion column. Cyanide and metal cyanide complexes are ionized and could also be removed directly from the wastewater by anion exchange. Mixing cyanide wastes with the rest of the plant's wastewater is potentially hazardous, however; toxic hydrocyanic gas (HCN) would result from contact with acidic wastes. Therefore, cyanide wastewaters are normally pretreated before they are blended with the rest of the wastewater. In many cases, an integrated chemical waste system (Figure 6) can provide cyanide pretreatment that is low in cost and easy to operate.

The usual ion exchange sequence is cationic exchange followed by anionic exchange. The reverse sequence is avoided because passing the solution first through an anion exchange column would increase pH and could precipitate heavy metal hydroxides.

System Description

An ion exchange wastewater recycle system is shown in Figure 7. The major process components include:

- Wastewater storage
- Prefilters
- Ion exchange columns
- Regeneration system
- Batch treatment for regenerant solutions
- Deionized water storage

Wastewater Storage. A collection sump or storage tank is needed to provide a surge volume in the

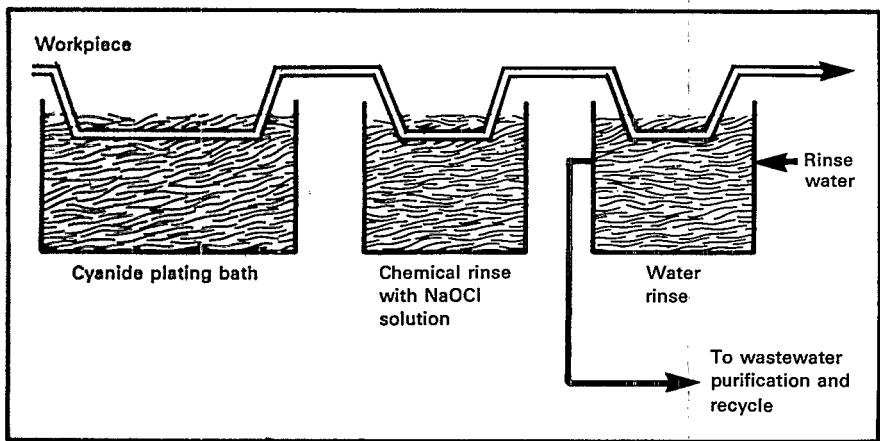


Figure 6.
Integrated Chemical Rinse to Oxidize Cyanide Compounds

Regular skimming can then purge the oil from the recycle system.

Prefilters. Activated carbon columns are commonly used as ion exchange prefilters. The carbon columns provide a versatile pretreatment system; they can:

- Filter out suspended solids that could hydraulically foul the columns.
- React with free chlorine or other strong oxidants that could physically degrade the resin.
- Adsorb organics that would otherwise build up in the recirculated wastewater.
- Adsorb oils that would gradually foul the resin.

system and allow the exchangers to be fed at a constant rate. The unagitated collection tank can also be used to settle coarse solids in the wastewater. The collected

solids can be pumped out at regular intervals and disposed of. Tank design should allow any free oil to separate and then collect on the surface of the wastewater.

The columns are typically back-washed daily to remove collected suspended solids. The backwash water goes either to the wastewater storage tank or to the batch treatment tank. Carbon replace-

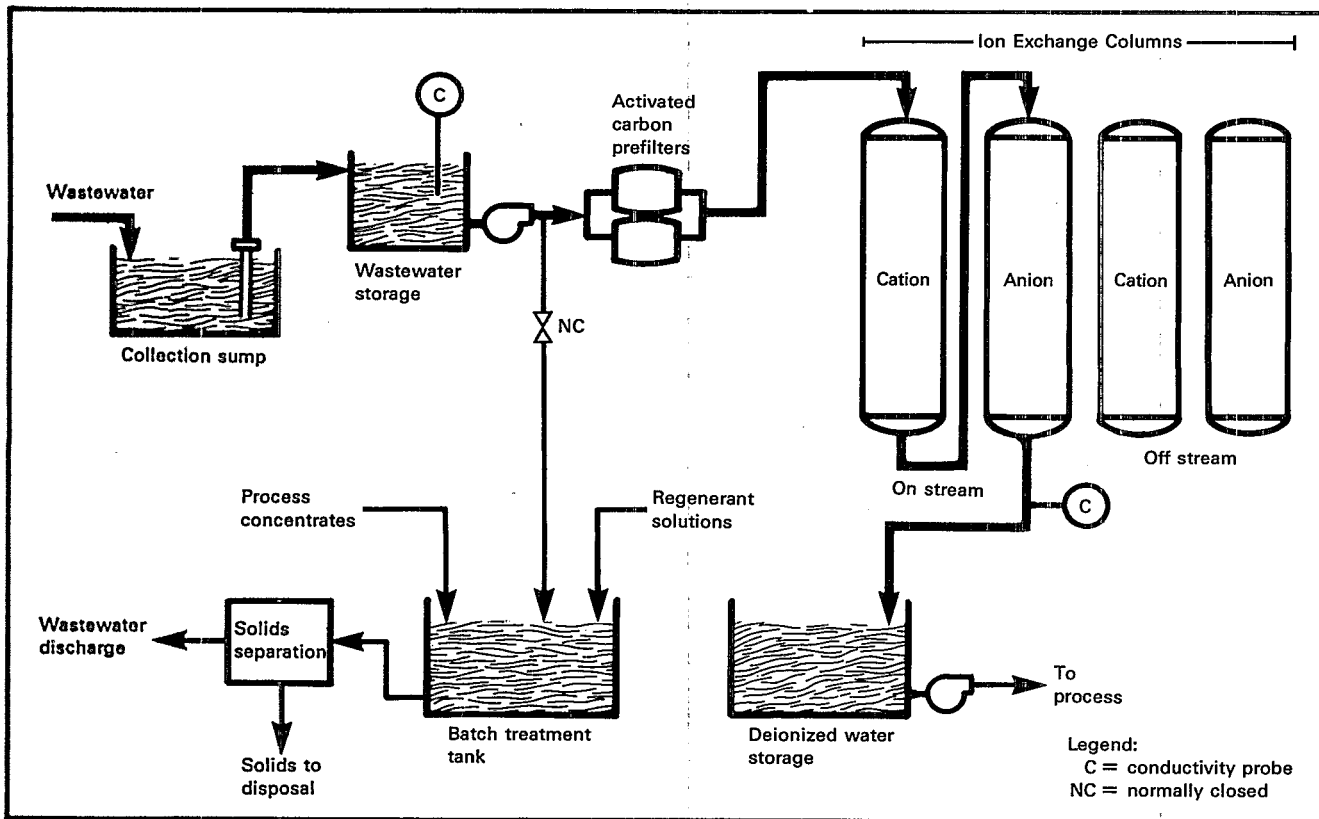


Figure 7.
Ion Exchange Wastewater Purification and Recycle System

ment frequency depends primarily on loading of oils or organics. If the carbon is not replaced, organic impurities can gradually build up in the recycle water. Some long chain organic molecules will foul strong base resins. Oil not removed by pretreatment collects on the resin and reduces its exchange capacity, resulting in more frequent regeneration and higher operating costs. Cleaning solutions are available from resin manufacturers to restore the performance of oil-fouled resin beds.

Ion Exchange Columns. In the most common column configuration, wastewater passes in series through a strong acid cation resin column and then through either a strong or weak base anion resin column. Weak base resins have higher exchange capacities and require less regenerant than do strong base resins. On the other hand, weak base resins are not effective in removing weakly ionized bicarbonates, borates, and silicates, nor can they operate effectively at high pH. These limitations may not be a concern for metal finishing wastewaters, and weak base resins are recommended. If these anions are present in significant amounts, an anion bed containing both strong and weak base resins can be used. A bed of this kind will approach the higher exchange capacity and regeneration efficiency of a weak base system but provide complete deionization.

To provide uninterrupted system operation when column regeneration is required, two sets of columns are frequently installed. When one set has been exhausted, flow is switched to the off-stream set and the spent columns are regenerated.

Regeneration System. The cation exchange column should be regenerated with hydrochloric acid after exhaustion. Despite its higher cost, HCl is favored over H_2SO_4 for regeneration if the wastewater contains a significant amount of calcium.

In such a case, regeneration with sulfuric acid can result in precipitation of calcium sulfate and hydraulic fouling of the resin bed. Calcium sulfate precipitation can be avoided by using dilute sulfuric acid solutions (2 percent by weight). Strong base anion columns are regenerated with sodium hydroxide. Weak base resins can be regenerated with sodium hydroxide or less expensive basic reagents such as sodium carbonate.

Batch Treatment for Regenerant Solutions. The pollutants removed by the ion exchange system will be concentrated in the regenerant and wash solutions. These solutions must undergo conventional treatment before being discharged. The type of pollutants present (Cr^{+6} and heavy metals would be most common) dictates the treatment sequence that would be required.

Deionized Water Storage. A storage tank is used to provide an inventory of water for process needs. The effluent from the ion exchange column should be monitored with a conductivity probe to provide a relative index of the level of dissolved solids in the treated water. When the water conductivity increases to a certain level, the columns are switched and the spent columns are regenerated. Because complete water deionization is not needed for most process applications, the columns are loaded until the maximum allowable level of impurity is reached before they are regenerated; regeneration frequency and system operating costs are thus reduced.

Ion Exchange Column Specification

Columns are usually sized as a function of the ratio of wastewater volume to resin volume. Recommended rates vary depending on the application but as a rule range from 2 to 4 gal/min/ft³ (0.26 to 0.52 L/min/L) of resin. Higher rates will usually result in higher leakage, but will not affect the

quantity of ionic compounds the resin bed can exchange.

For rinse water recovery, leakage of small concentrations of ionic compounds would not signal the end of the cycle. Therefore, rates should be selected from the higher end of the recommended range to minimize the initial cost of the system. Smaller columns will increase regeneration frequency and the associated labor cost. For columns with automated regeneration packages, increased regeneration frequency will not significantly increase operating costs.

Cost

Conventional end-of-pipe treatment requires removing pollutants from large volumes of dilute wastewater. When pollutants are concentrated into small volume regenerant solutions, treatment is usually more economical. Moreover, recycling the purified wastewater reduces operating costs associated with water consumption and sewer fees.

As a rule, treating the concentrated regenerant solutions will consume chemicals in quantities smaller than are needed to treat the same mass of pollutants in a dilute waste stream. Capital costs of wastewater treatment systems depend primarily on the unit operations required and the volumetric flowrate of the wastewater. Total investment for an ion exchange water recycle system and a simplified batch chemical destruct unit to treat concentrated solutions will often be less than that for a conventional chemical destruct system designed to treat the total volume of water consumed by a plant.

Operating Cost. Operating costs for an ion exchange purification system to treat wastewater containing a variety of heavy metals will include:

- Chemicals for column regeneration

- Destruct chemicals for treatment of concentrated regenerant solutions and purged wash water
- Disposal of the treatment residue
- Labor for column regeneration and operation of the batch treatment system (if not automated)
- Maintenance
- Resin and activated carbon replacement
- Utilities

How these costs compare with the costs of operating a conventional hydroxide treatment process can be determined by evaluating the costs associated with each system treating the same waste stream. To simplify the analysis, equal labor, maintenance, and utility charges are assumed for both systems.

A typical waste stream (Table 4) consisting of rinses after nickel, copper, and chromium plating baths and acid and alkali process baths will be used in the cost analysis. In a water recycle system, only natural alkalinity brought in with makeup water must be treated; recycled water has already had its initial alkalinity removed. The wastewater used in conventional treatment, however, contains all the natural alkalinity brought in with the fresh water; as a result more alkali reagent will be consumed and more solid waste generated.

In light of the foregoing analysis, the next step is to determine the required column configuration and size of the ion exchange unit. Either of two column configurations can be used: strong acid and strong base or strong acid and weak base. In either case, ion exchange column sizing is based on volumetric loading. At the normally recommended service flowrate of 2 gal/min/ft³ (0.26 L/min/L) of resin, columns containing 15 ft³ (425 L) of resin will be needed. The ion exchange capacity of these columns will depend on the quantity of regenerant (dosage rate).

Using the resin capacities given in Figure 4, the columns will be

Table 4.

Wastewater Characteristics and Ion Exchange Capacity Requirements

Item	Treatment	
	Ion exchange	Conventional
Wastewater characteristic:		
Flowrate (gal/min)	30	30
Constituent (ppm):		
Cu ⁺²	40	40
Ni ⁺²	40	40
CrO ₄ ⁻²	50	50
Na ⁺	20	20
SO ₄ ⁻²	150	220
Total dissolved solids	310	470
Alkalinity, as Ca(HCO ₃) ₂ (ppm)	10	70
Wastewater concentrations to be treated by ion exchange (eq/L):		
Cations ^a	0.0036	—
Anions	0.00423	—
Ion exchange resin capacity needed for 15-ft ³ bed (eq/L): ^b		
Cation resin ^a	0.92	—
Anion resin	1.08	—

^aDoes not include hydrogen ions.

^b16-h operating cycle.

regenerated with sufficient acid and base to provide 1 day's operating capacity. The plant is assumed to operate 16 h/d. Table 4 includes the resin capacity needed for columns with 15 ft³ (425 L) of resin.

For the strong acid/strong base unit, sufficient capacity would be obtained in the anion column with a regenerant level of 6.5 lb NaOH/ft³ (104 g NaOH/L) of resin. The anion column would require greater capacity than the cation column because the wastewater is acidic; the higher anionic loading

rate results from the anions associated with the hydrogen ion acidity. Adequate capacity would be obtained in the cation column with a regenerant level of 4 lb HCl/ft³ (64 g HCl/L) of resin. In this case, however, the combined anion and cation column regenerant must be acidified to reduce Cr⁺⁶. Therefore, excess acid regenerant [6.5 lb/ft³ (104 g/L)] can be used to balance the excess NaOH in the anion regenerant.

Table 5 shows the chemical content and volumes of the regenerant solutions after they are mixed with

Table 5.

Regenerant Solution Chemical Content

Item	Strong acid/ strong base	Strong acid/ weak base
Volume	850 gal	800 gal
Cation column		
	20.3 lb CuCl ₂	20.3 lb CuCl ₂
	21.1 lb NiCl ₂	21.1 lb NiCl ₂
	12.1 lb NaCl	12.1 lb NaCl
	1.6 lb CaCl ₂	1.6 lb CaCl ₂
	67.0 lb HCl	29.5 lb HCl
Anion column		
	16.8 lb Na ₂ CrO ₄	16.8 lb Na ₂ CrO ₄
	53.3 lb Na ₂ SO ₄	53.8 lb Na ₂ SO ₄
	3.0 lb Na ₂ CO ₃	3.0 lb Na ₂ CO ₃
	56.9 lb NaOH	7.4 lb NaOH

the volume of wash water [50 gal/ft³ (6.5 L/L) of resin] usually required for the backwash and rinse stages of regeneration. Chemical cost of each regeneration cycle is \$29.83 for the strong acid and strong base system (based on Table 6).

Regeneration cost can be reduced if a weak base resin is used in the anion column. A weak base resin downstream of the strong acid column is suited for this application because the entering wastewater would always be acidic. Based on the capacity shown in Figure 5, sufficient resin capacity could be achieved with a sodium hydroxide dose equal to 3.2 lb/ft³ (51 g/L) of resin. The amount of acid consumed

Table 6.
Chemical Prices

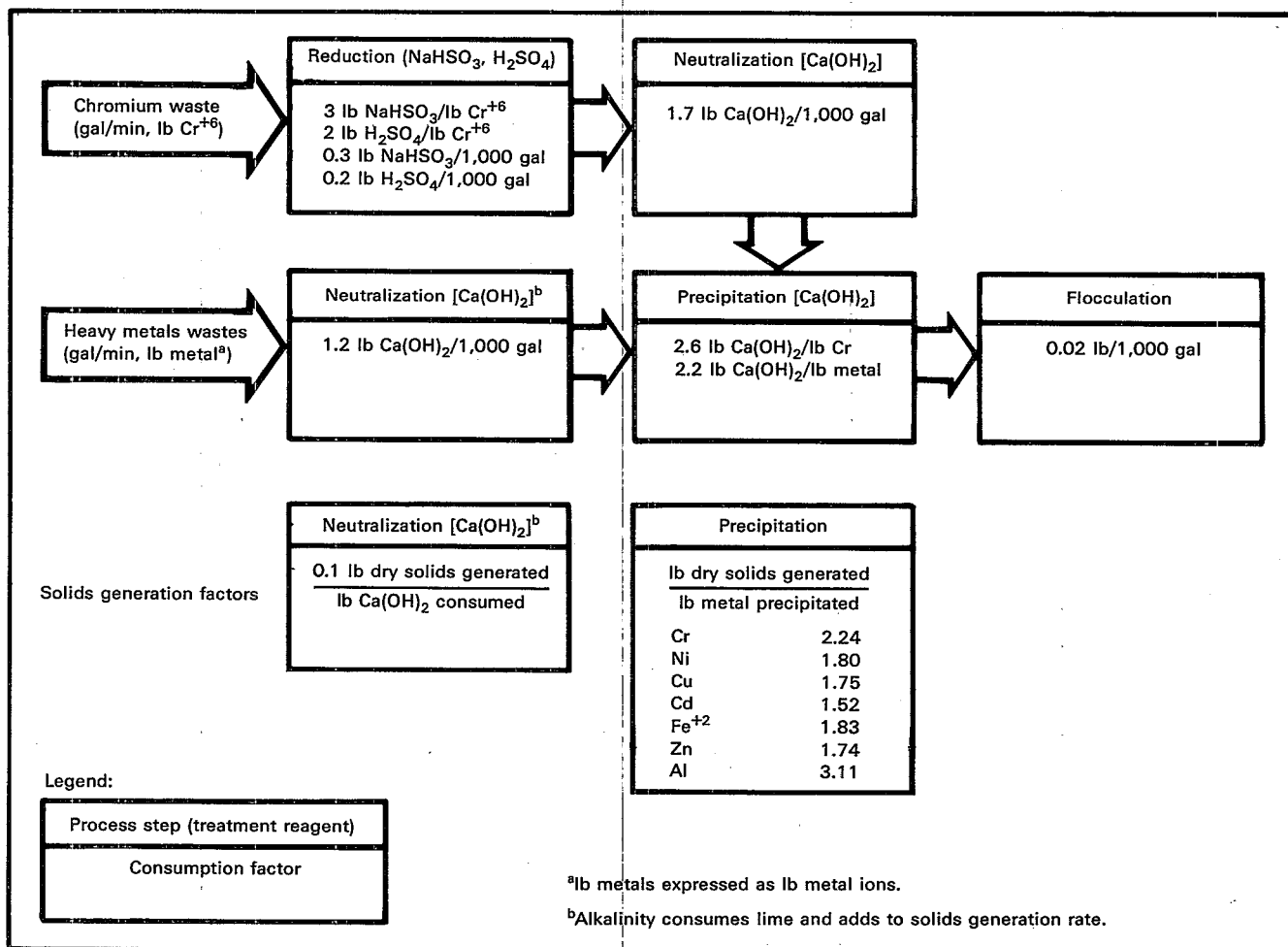
Reagent	Description	Cost (\$/lb) ^a
Hydrochloric acid	Carboys, 32% HCl	0.05
Sodium hydroxide	Carboys, 50% NaOH	0.075
Hydrated lime	100-lb bags	0.05
Sodium bisulfite	100-lb bags	0.20
Sulfuric acid	Carboys, 97% H ₂ SO ₄	0.05
Polyelectrolyte	Dry powder	2.50

^a1980 dollars.

for regeneration should be reduced to the minimum required for column capacity, 4 lb HCl/ft³ (64 g HCl/L) of resin. Table 5 includes the volume and chemical content of the regenerant solutions. Regen-

erant chemicals for this column configuration would cost \$16.56 for each cycle.

Based on treatment chemical consumption factors (Figure 8) and



^alb metals expressed as lb metal ions.

^bAlkalinity consumes lime and adds to solids generation rate.

Figure 8.
Conventional Treatment Chemical Consumption Factors

Table 7.
Daily Treatment Cost Comparison: Ion Exchange and Conventional Systems

Component	Treatment cost (\$/d)		
	Strong acid/ strong base	Strong acid/ weak base	Conventional
Chromium reduction:			
NaHSO ₃	3.34	3.34	3.82 ^a
H ₂ SO ₄	(^b)	(^b)	0.63
Neutralization: Ca(OH) ₂	3.76	4.08	5.16
Sludge disposal ^c	3.70 ^d	3.70 ^d	4.97 ^e
Ion exchange regeneration:			
HCl	15.21	9.36	(^b)
NaOH	14.62	7.20	(^b)
Total chemical cost	40.63	27.68	14.58
Water and sewer fee at \$1/1,000 gal	1.70	1.70	28.80
Total treatment cost	42.33	29.38	43.38

^aAssumes 10 gal/min of segregated Cr⁺⁶ wastewater.

^bNot required.

^c25% solids by weight at \$0.20/gal.

^dFor 46.3 lb dry solids.

^eFor 62.2 lb dry solids.

Note.—1980 dollars.

chemical costs (Table 6), Table 7 compares the daily cost to operate the two ion exchange systems with the cost for a conventional treatment system. Although the chemical costs are higher for the ion exchange systems, when the savings in water and sewer fees (assuming \$1/1,000 gal) are considered, the total cost is less than that of conventional treatment. The data also indicate that a strong acid/weak base column configuration is considerably less expensive to operate than the strong acid/strong base configuration. The economics of the ion exchange system could be improved further if the strong acid column regenerant were reused.

For deionization applications, commercially available resins cost between \$50/ft³ and \$200/ft³. Ion exchange resins usually need replac-

ing every 2 to 5 years, depending on the type of resin and the process application. Resins can be damaged by exposure to strong oxidants, long chain organic compounds, or oil. With proper selection of resins and effective pretreatment of the wastewater, the potential for resin deterioration and the cost for replacement will be reduced.

Granular activated carbon must be replaced when its adsorption capacity is spent. For small scale applications, regenerating the carbon is not economically feasible. Replacement frequency for activated carbon will depend on the level of organic compounds in the wastewater. Carbon adsorption is an economical means of removing trace amounts of organic compounds from solution. If high levels of organics are present, however, the cost becomes excessive and alternative removal techniques should be evaluated.

Effect of Pollutant Concentration. The volume of wastewater that can be deionized by an ion exchange column is in direct proportion to the ionic concentration of the wastewater and is not influenced by the volume needing treatment. Consequently, when dilute solutions are processed, a large volume can be treated before column capacity is exhausted and regeneration is required. On the other hand, conventional treatment processes—such as chromium reduction, cyanide oxidation, and metal precipitation—must adjust the chemistry of the water solution to achieve the desired reaction. The chemical consumption associated with these processes therefore depends on both the mass of pollutant and the volume of solution to be treated. Because its cost is independent of solution volume, ion exchange processing is highly efficient in terms of chemical consumption when used to treat dilute concentrations of ionic contaminants.

Figure 9a shows the relative costs of deionization and conventional treatment techniques as a function of the concentration of wastewater contaminants for acid-alkali waste streams and for hexavalent chromium wastewater. Only chemical treatment costs are included, not water and sewer use fees. The treatment steps and assumptions used to derive the conventional treatment cost are presented in Table 6 and Figure 8. Also assumed is removal of natural alkalinity during treatment.

Ion exchange does not compare favorably with hydroxide precipitation of acid-alkali waste streams except at very dilute concentrations. For treating typical metal finishing wastewater, hydroxide precipitation will usually have lower

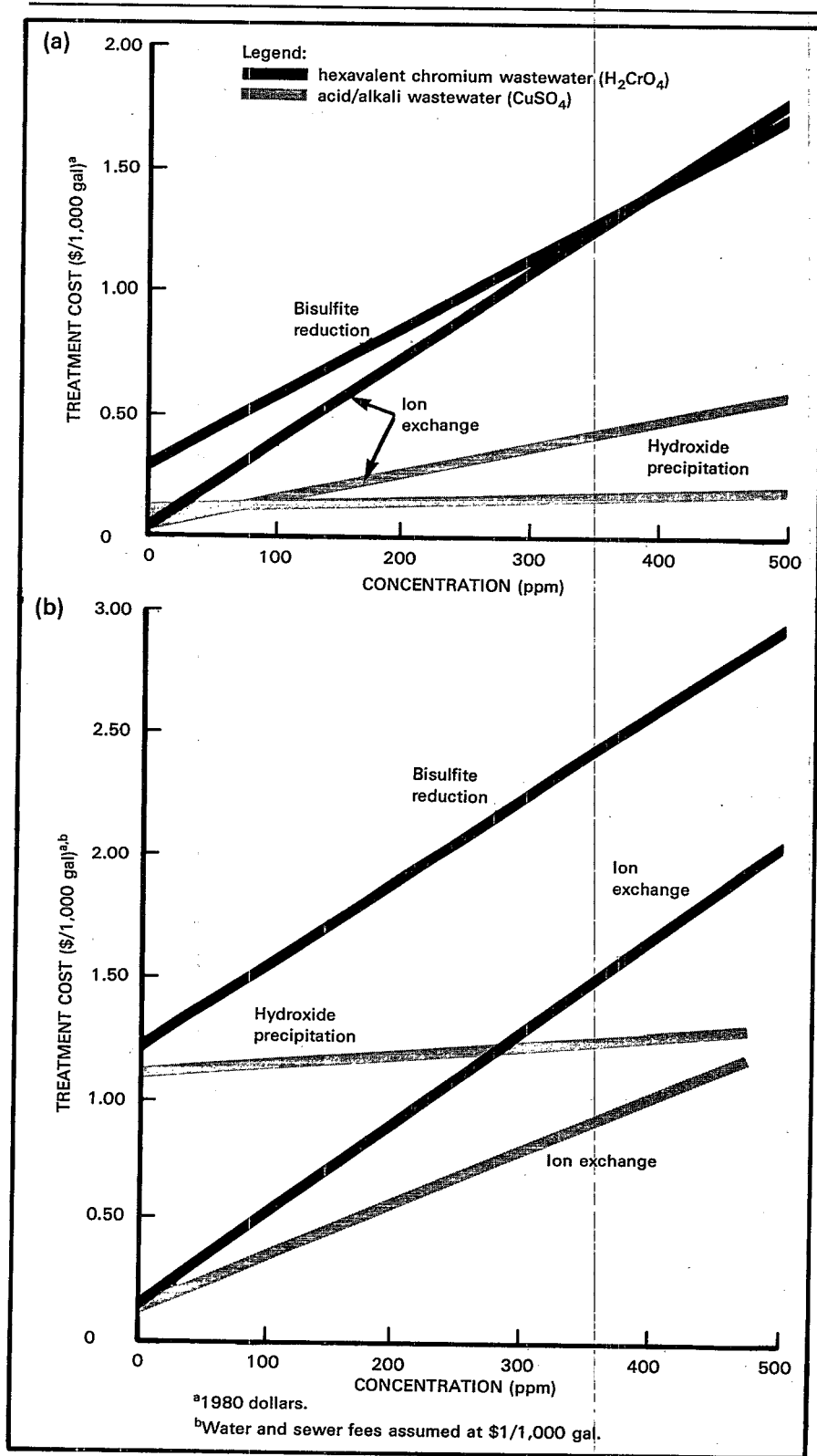


Figure 9.

Cost Comparisons for Ion Exchange and Conventional Treatment Systems:
(a) Chemical Cost Only and (b) Chemical Cost and Water Use Fees

chemical costs. For hexavalent chromium wastewater, however, ion exchange has a treatment cost advantage up to a concentration of 440 ppm of chromic acid (H₂CrO₄). Ion exchange treatment is efficient for this application partly because, except for contaminants, chromic acid wastewater has no cations other than hydrogen; consequently, treatment by ion exchange would not affect cation column operating costs.

In Figure 9a the cost for conventional treatment of acid-alkali wastes includes the volume-related cost for lime to adjust solution pH and to react with naturally occurring bicarbonate alkalinity, and for polyelectrolyte conditioners to aid in precipitant settling. The curve for chromium reduction using bisulfite includes these cost components plus costs for acid needed to bring the wastewater to required reaction pH and base for subsequent neutralization.

The ion exchange system costs are based on 90 percent water recycle; they include the cost for column regeneration and treatment of regenerant solutions by conventional techniques. The regenerant chemical consumption is based on a strong acid/weak base column configuration.

An ion exchange water recycle system becomes considerably more attractive than conventional treatment techniques if the credit for savings in water and sewer fees is included in the analysis. Figure 9b compares treatment costs of the same two waste streams but includes a cost equal to \$1/1,000 gal water consumed.

Waste Reduction. The waste stream volume reduction achieved by a wastewater deionization system relates directly to the con-

centration level of the dissolved ionic solids in the wastewater. The reduction in volume of the waste stream and its favorable effect on both the initial and operating cost of wastewater treatment are part of the justification for using ion exchange.

Each cubic foot of resin in a column system can remove a specific quantity of ions; regenerating and washing that volume of resin will result in a purge stream of limited concentration.

Consider an ion exchange system with a strong acid/weak base column configuration. Assume the resin in each column has a capacity of 1.5 eq/L, and that regenerating the columns produces purge (regeneration plus rinsing) in the amount of 50 gal/ft³ (6.5 L/L) of resin. The maximum concentration of the ionic solids in the combined purge streams from both columns, then, would be 0.11 eq/L. Expressed in terms of a typical metal salt, the maximum concentration of copper sulfate (CuSO₄) in the purge solution would be 1.75 percent. Using this relationship, Figure 10 presents the volume reduction for treating wastewater over a range of ionic concentrations.

The relationship developed in Figure 10 is based on normal operating procedures. Concentration can be improved by selective recycle of part of the purge stream; however, the poor chemical efficiency of the ion exchange process for treating concentrated solutions and the poor degree of concentration achieved make other methods of treatment more suitable.

Capital Cost. In the metal finishing industry, most of the wastewater requiring treatment results from rinsing operations. Selective treatment and reuse of rinse streams by ion exchange can result in

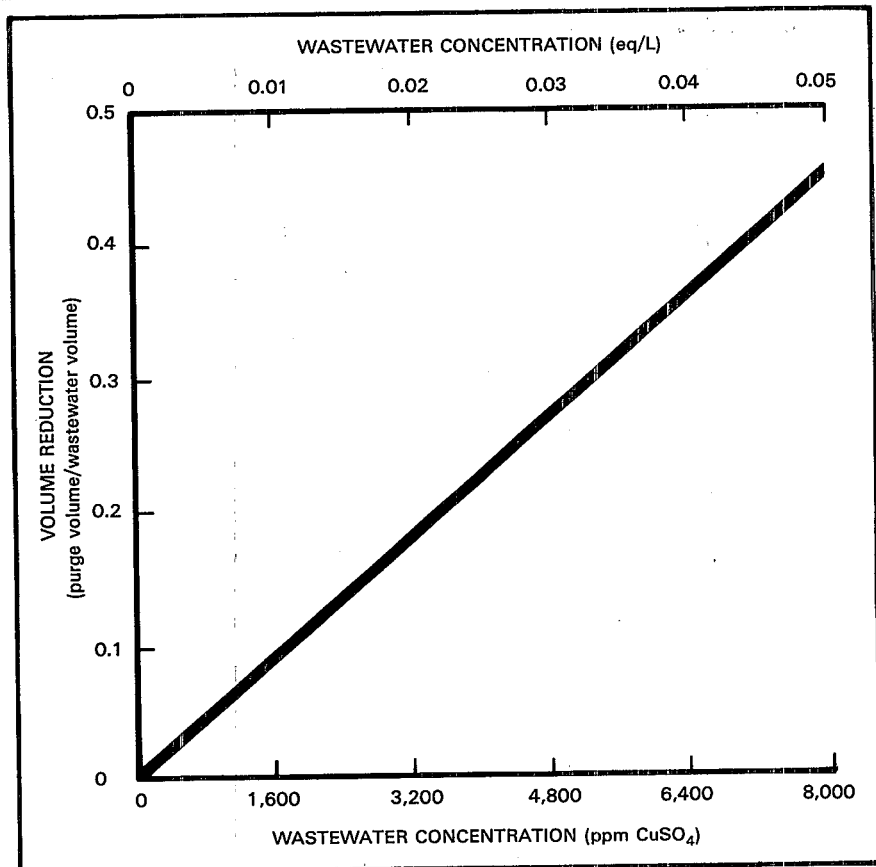


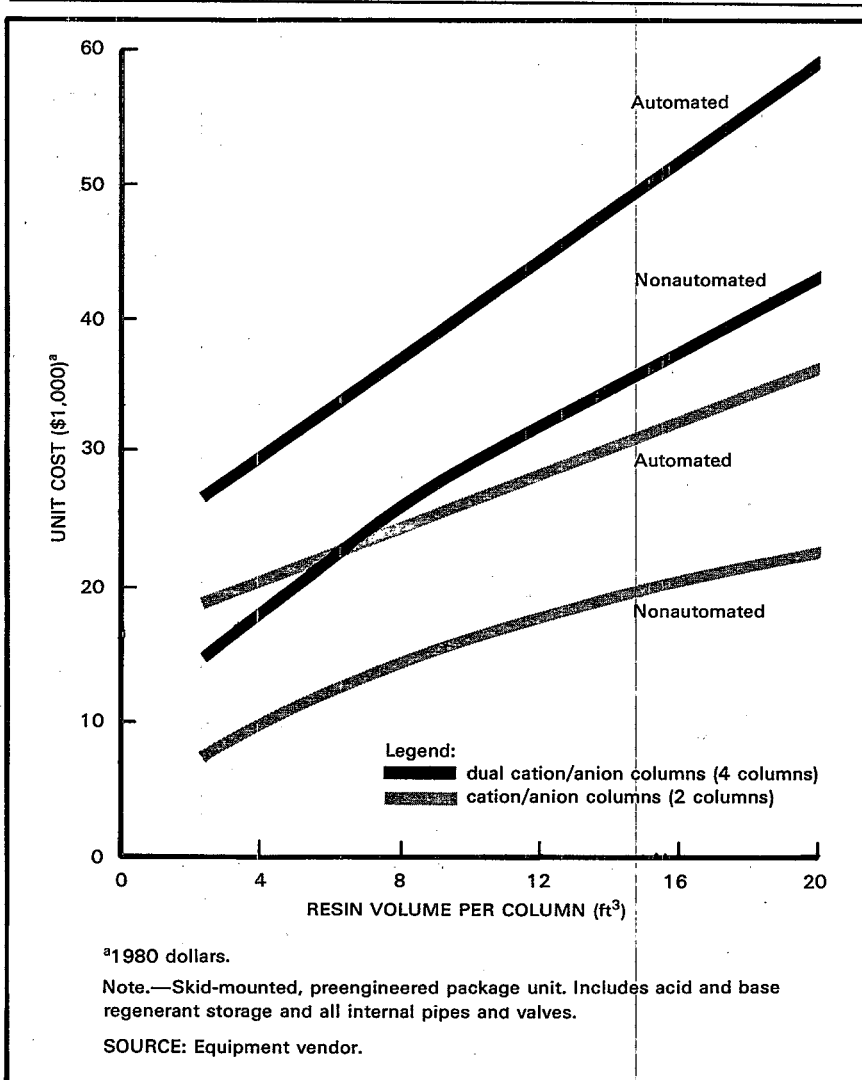
Figure 10.

Relationship of Waste Volume Reduction to Wastewater Ionic Concentration

considerable savings in the investment necessary for end-of-pipe treatment systems. This investment is usually a function of wastewater flowrate and the required unit operations. For flows above 15 to 20 gal/min (57 to 76 L/min), automated continuous treatment systems are usually recommended. A deionization water reuse system can result in flow reduction sufficient to make a single batch treatment tank feasible for treating regenerant solutions and any concentrated process dumps.

The cost for ion exchange column systems is increased significantly when dual cation-anion column configurations are needed for

continued operation during regeneration. Automation adds considerably to the initial cost of the unit but, in addition to savings in labor, can permit the use of smaller columns with more frequent regeneration. Figure 11 compares costs for two- and four-column ion exchange units, automated and nonautomated, as a function of resin volume in each column. The systems illustrated are skid mounted and preengineered; costs include the columns, an initial supply of resin, reagent storage, and internal piping and valves necessary for service and regeneration flow.



The cost of the auxiliary equipment described earlier for ion exchange water recycle will add considerably to the total capital cost associated with using the technology. The total cost, however, may still compare favorably with that for a conventional end-of-pipe treatment system.

Figure 11.
 Cost for Deionization Units With and Without Automation

End-of-Pipe Systems

Ion exchange can be used in two different ways for end-of-pipe pollution control. The process has been demonstrated as a means of polishing the effluent from conventional hydroxide precipitation to lower the heavy metal concentration further, and it has been used to process untreated wastewaters directly for removal of heavy metals and other regulated pollutants.

Most plating shops can achieve sufficient metal removal to comply with discharge regulations by employing the conventional hydroxide precipitation process. Conventional treatment may not be reliable, however, in achieving compliance with discharge limits in certain cases, including where:

- Unusually strict limits are placed on the effluent metal concentration.
- The metals are complexed with chemical constituents that interfere with their precipitation as metal hydroxides.

In such cases, the use of ion exchange to polish the effluent can provide relatively inexpensive upgrading of system performance for compliance with the regulations.

The development of special chelating resins made ion exchange feasible for selective removal of trace heavy metals from a water solution containing a high concentration of similarly charged, nontoxic ions. These resins exhibit a strong selectivity, or preference, for heavy metal ions over sodium, calcium, or magnesium ions. Weak acid cation resins also display a significant preference for heavy metal ions, and in some applications they are superior to the chelating resins in performance characteristics. In a polishing application, both resins can remove the heavy metal ions from the wastewater while leaving most of the nontoxic ions in solution. The preference for heavy metal ions allows a large volume of water to be

treated per unit of resin volume before the resin must be regenerated. The regenerant solution, which contains a high concentration of metal ions, is treated upstream in the conventional process (Figure 12a).

Ion exchange has received limited commercial application for selective removal of heavy metal and metal cyanide pollutants from an untreated wastewater while allowing most of the nontoxic ions to pass through. Various approaches have been employed to facilitate this application:

- A weak acid cation resin has been used in wastewater softening to remove heavy metals and other divalent cations from a wastewater solution with a high concentration of sodium cations.
- Heavy-metal-selective weak acid or chelating cation resin has been used to remove the heavy metal ions while allowing sodium, calcium, and magnesium ions to pass through.
- A stratified resin bed, containing strong and weak acid cation resins and strong base anion resins, has been employed to remove heavy metal cations and metal cyanide complex anions while allowing other ions to pass through.

In each of these approaches, wastewater pretreatment requirements consist of pH adjustment to ensure that pH is within the operating range of the resin, and filtration to remove suspended solids that would foul the resin bed (Figure 12b). The pollutants removed from the wastewater are concentrated in the ion exchange regenerant solutions. The regenerants can be treated in a small batch treatment system using conventional processes. Firms with access to a centralized treatment facility that accepts industrial wastes can use the

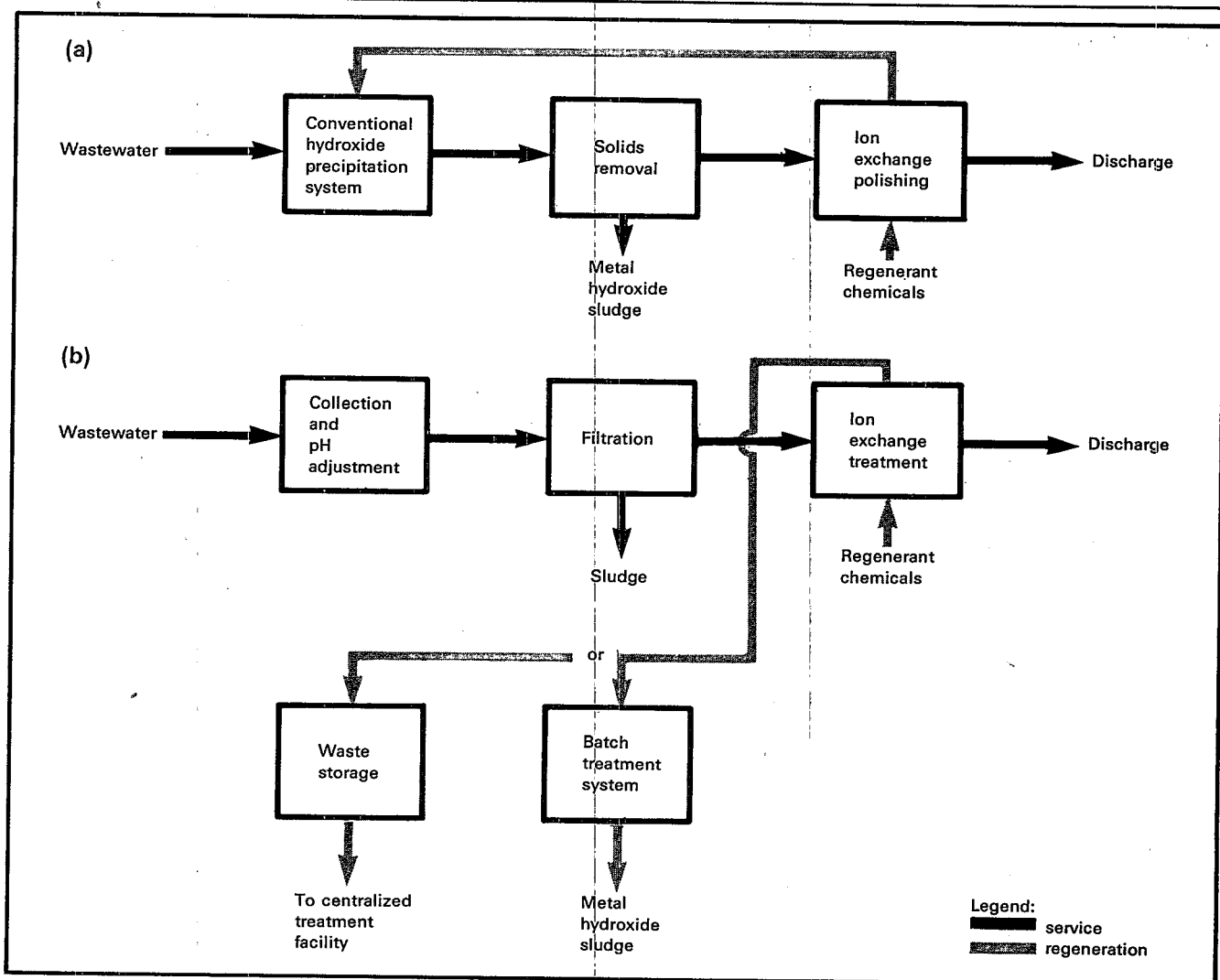


Figure 12.
Ion Exchange Systems: (a) Polishing and (b) End-of-Pipe Treatment

facility to dispose of the regenerant solutions and need not install chemical destruct systems. In either case, no investment is needed for sophisticated pH control systems, flocculant feed systems, clarifiers, and other process equipment associated with conventional continuous treatment systems, and ion exchange becomes attractive in terms of cost. And, as a further advantage, ion exchange units are compact and easy to automate compared with conventional treatment systems.

Ion Exchange Polishing Systems

Process Description. Figure 13 shows a treatment system employing:

- Hydroxide neutralization to control pH and to precipitate heavy metals as metal hydroxides
- Flocculation to agglomerate the suspended solids
- Clarification and deep-bed filtration to remove the precipitated metals and suspended solids

- Ion exchange polishing to reduce residual metal solubility before the water is discharged

For effective metal removal by hydroxide precipitation, pH must be controlled within the narrow range where the metals are least soluble. Such narrow control usually requires sufficient retention time within the pH adjustment tank to ensure minimum variation in neutralizing reagent demand. Multistage neutralizers and sophisticated control loops are also used to minimize deviation from the pH

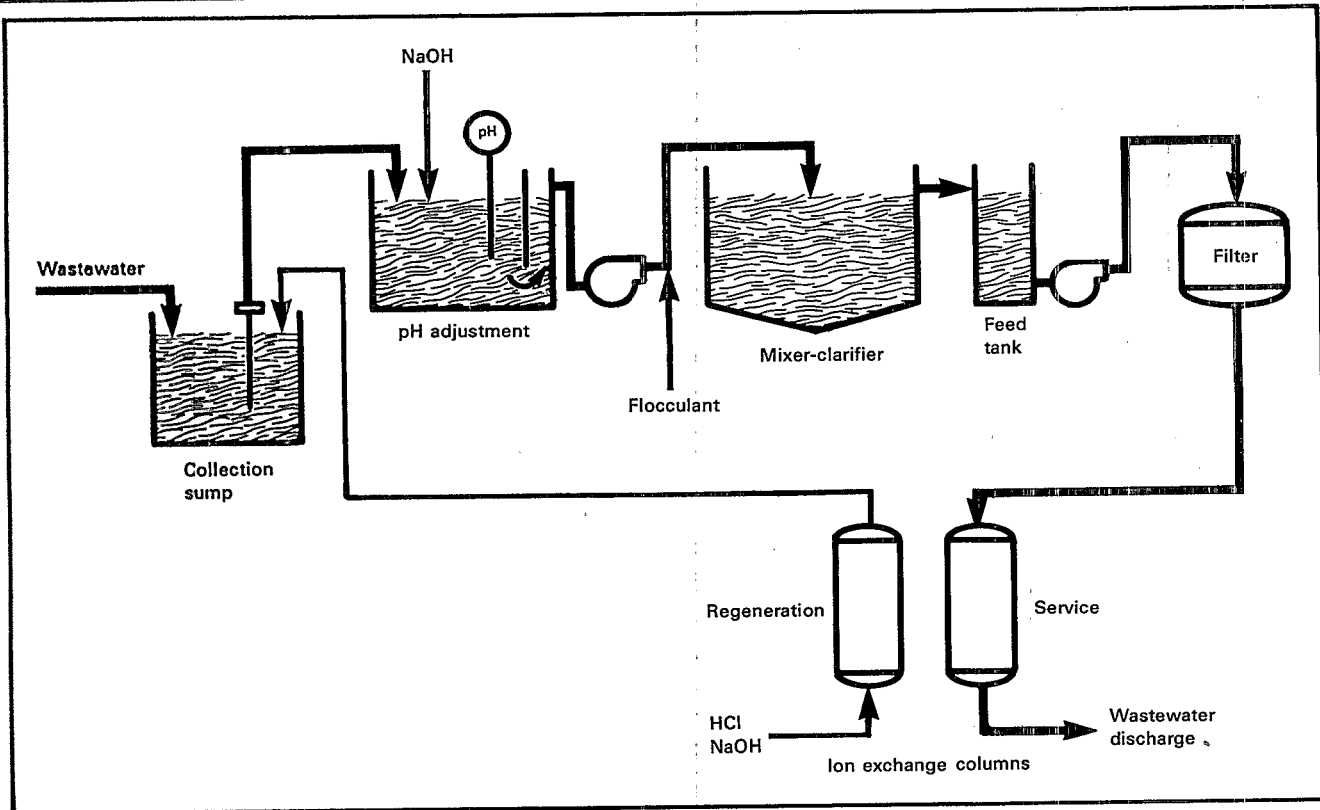


Figure 13.
Conventional Treatment System With Ion Exchange Polishing

control set-point. With effective pH control, most of the metals in the wastewater will precipitate as metal hydroxides.

To provide effective removal of precipitated metals and other suspended solids, coagulating-flocculating compounds are added to the neutralized wastewater to agglomerate the solids and facilitate their removal. Most of the suspended solids can be removed by clarification; however, removal of fine particles (including precipitated metals) requires filtration. Deep-bed filters, which remove solids by passing the wastewater through a bed of sand and gravel, are used most frequently.

For most waste streams, the unit operation sequence of hydroxide precipitation, flocculation, clarification, and filtration will produce an effluent with a minimum heavy metal content and achieve compliance with discharge permit regulations. In cases where the metal content exceeds the permit limit, and the excess is in the form of dissolved metals (as opposed to metal hydroxide particles not removed during solids separation), a polishing treatment using ion exchange resins will reduce the effluent metal concentrations.

The failure of hydroxide precipitation to reduce metal solubility to the required level can be caused by one of the following:

- Failure to control pH within the narrow range necessary for minimal metal solubility

- The presence of chelating compounds that combine with metals to form complexes not effectively removed by hydroxide precipitation
- Discharge limits requiring metal concentrations below those which a hydroxide treatment system can achieve consistently and reliably

Resin Selection. Ion exchange heavy-metal polishing systems will usually use a chelating heavy-metal-selective cation resin. A resin of this kind forms an essentially non-ionized complex with divalent metal ions. Consequently, once an exchanger group is converted to the heavy metal form, it is relatively unreactive with other similarly charged ions in solution. Despite high concentrations of non-heavy-

metal cations competing for the exchange sites, the resin has sufficient preference for the heavy metal ions to exhibit a high metal-holding capacity per unit of resin volume. The chelating resins will effectively remove heavy metal cations from solutions with a pH above 4.0.

Weak acid cation resins also have potential for use in ion exchange polishing systems. These resins have the advantage of being less expensive than chelating cation resins, and they require less chemicals for regeneration. On the other hand, weak acid resins are not effective in acidic solutions; moreover, they are less selective for heavy metal cations over other divalent calcium and magnesium ions than are chelating resins.

Polishing System Equipment and Auxiliaries. The ion exchange polishing system consists of:

- Column or columns containing the resin
- Acid regenerant storage
- Sodium hydroxide regenerant storage
- Piping and valving to facilitate on-stream wastewater treatment, and regeneration and backwashing of the resin bed

Three ion exchange column configurations for a polishing system are:

- Single column
- Series column
- Parallel column

Unlike deionization systems, which require both a cation and an anion resin column, the polishing system usually requires only one kind of resin. Consequently, a single column design is feasible for small flows where the wastewater discharge can be interrupted to allow for column regeneration. Discharge permits are usually based on a daily composite sample, and this factor should be considered in evaluating use of a single column. Often the composite effluent quality of a treatment system that is

off stream 10 percent of the time for regeneration in any given day will achieve the discharge permit limits. Mechanical failures and system maintenance are inevitable consequences of using the process, however, and the reliability of a single column design is probably inadequate in most applications.

In none of the polishing system column configurations is there a simple means of detecting the breakthrough of metal ions that would indicate a need for column regeneration. Metal breakthrough is avoided by loading the column only to some fraction of its exchange capacity. A series column configuration, where the total flow of wastewater passes through each column, is particularly reliable in ensuring contact of the wastewater with a large volume of unreacted resin. After the up-stream column is exhausted, it is taken off stream, regenerated, and returned to service as the down-stream column. This configuration minimizes the possibility that the resin will be exhausted and that metal breakthrough will occur. On the other hand, pressure drop over the system will be high and each column must be sized to process the total flow.

A parallel column configuration employing three or more columns has advantages, particularly for larger flows. Both equipment cost and reliability are intermediate between the single and series column configurations. In a parallel configuration, each column is sized based on the assumption that one column is always off stream for regeneration. This design reduces the total resin volume requirements compared with those of a series column design. Using a bank of small columns does increase regeneration frequency; many of the units are designed with automated regeneration capabilities, however, and more frequent regeneration does not increase the need for operating labor.

Operating Procedure. Operation of an ion exchange polishing system is complicated by the lack of practical means for determining when the column is exhausted and metal breakthrough occurs. Unlike deionization systems, where a conductivity probe will signal the end of a column cycle, polishing systems have no simple, direct technique for continuously monitoring the levels of heavy metals in the effluent. To compensate for this lack, the columns are operated on either a time or flow cycle. This approach requires determining the column exchange capacity and the loading per unit volume of wastewater. Then, based on the resin volume in the column, the volume of wastewater that can be processed before exhausting the exchange sites can be estimated. As a rule, to provide a factor of safety, a capacity equal to three-quarters of the actual exchange capacity is used to determine the volume that can be processed per cycle.

For a constant flow system, the volume capacity can be converted to a cycle time. A flow totalizer can be used for variable flow systems to monitor the cumulative volume and indicate when the column should be regenerated. Many manufacturers provide automatic regeneration capabilities with their column systems. For such systems, the control mechanism can be directed to begin regeneration by either a timing device or a flow totalizer.

The regeneration sequence for a chelating and a weak acid cation resin is:

1. Water backwash to remove suspended solids from resin bed
2. Acid regeneration
3. Water wash to remove residual acid
4. Sodium hydroxide regeneration
5. Water backwash to remove residual caustic and reclassify the resin particles
6. Cocurrent fast rinse to ensure that the resin bed's flow charac-

teristics are adequate and to remove any unused reagents
7. Return to service

The resin is used in the sodium form even though it adds extra steps to the regeneration process and increases the chemical consumption. Treating an alkaline waste stream with a resin in the hydrogen form would gradually result in conversion of the resin to either the sodium or calcium form; however, the exchange for hydrogen ions would depress the effluent pH below the control limitations and result in a period of noncompliance. Also, the resin exhibits a greater selectivity for heavy metals in the sodium form.

Hydrochloric acid is normally used for acid regeneration although it is more expensive than sulfuric acid. Sulfuric acid regeneration could result in the precipitation of magnesium or calcium sulfate during regeneration, and the resin bed could thus be hydraulically fouled. This effect can be avoided, however, if a dilute (2-percent) sulfuric acid regenerant solution is used.

The final backwash to reclassify the resin bed is critical. "Classification" refers to positioning the resin particles so that the largest particles are at the base of the column and the particle size gradually decreases as distance from the base increases. This arrangement results in maximum flowrate per unit of pressure drop and makes the bed more resistant to fouling from suspended solids in the column feed.

With strong acid and base resins, an initial backwash before regeneration is usually sufficient to ensure good flow characteristics during the service cycle. In the case of weak acid or chelating resins, however, the resin beads swell considerably when converted to the hydrogen form and subse-

Table 8.

Ion Exchange Polishing System Performance Characteristics

Item	Characteristic	Value
Ion exchange column	Chelating resin	10 ft ³
	Wastewater volume	120,000 gal/cycle
	Resin capacity	0.87 lb Ni/ft ³ 0.03 lb Cu/ft ³
Service:		
Wastewater to column	pH	8.4
	Ni ⁺²	8.9 ppm
	Cu ⁺²	0.3 ppm
Discharge	pH	8.4
	Ni ⁺²	0.16 ppm
	Cu ⁺²	0.02 ppm
Regeneration:		
Flow to column	Wash water	500 gal/cycle
	5% NaOH	68 gal/cycle
	5% HCl	65 gal/cycle
	Volume	633 gal/cycle
Purge streams	Nickel	0.16%
	Copper	0.006%

quently shrink when converted to the sodium form, which necessitates a final backwash before the column is returned to service.

All regenerant and wash solutions are sent to the hydroxide treatment system for processing. Table 8 presents a typical polishing system performance with volume of wastewater processed and the relative volumes of the regenerant streams.

System Performance. The number of ion exchange polishing systems installed to date is limited; however, abundant pilot test data verify system effectiveness in reducing the soluble metal content of a neutralized waste stream. The data from these controlled experiments can lead to a better understanding of how process variables and design factors influence performance.

Volumetric loading for ion exchange systems is usually expressed in bed volumes (bv) of solution treated per hour or in gallons per minute per cubic foot (liters per minute per liter) of resin. Both measures describe loading in terms of the volume of solution treated per volume of resin in a unit

of time. In essence, they define the length of time the solution is in contact with the resin.

Figure 14 shows the concentration profile of the effluent from a pilot test column containing a chelating resin. The feed solution has an initial cadmium concentration of 50 ppm, a calcium chloride (CaCl₂) concentration of 1,000 ppm, and a pH of 4.0. Tests were run at two different volumetric loadings: 8 bv/h [1 gal/min/ft³ (0.13 L/min/L)] and 16 bv/h [2 gal/min/ft³ (0.26 L/min/L)]. The higher loading resulted in earlier breakthrough. Assuming the column cycle is terminated at a cadmium concentration of 2.0 ppm in the effluent, the 8-bv/h system could treat 400 bv before regeneration, compared with 325 bv for a system operating at 16 bv/h.

The influence of volumetric loading on capacity results in a trade-off between investment and operating cost. Specifying a larger, more expensive column will result in greater capacity per unit volume of resin and less frequent and more efficient regeneration.

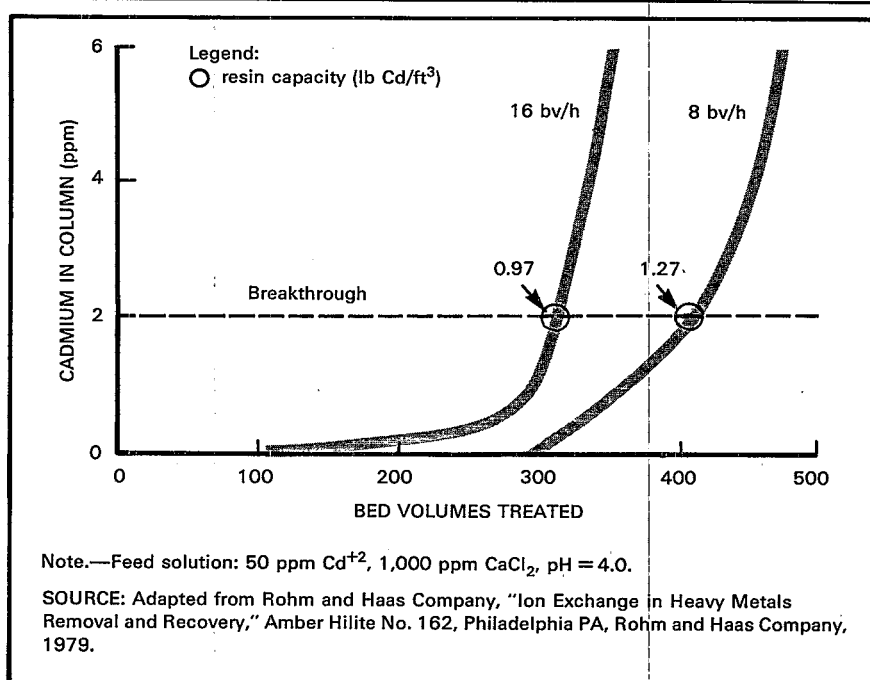


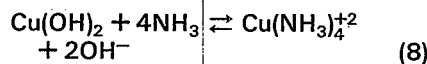
Figure 14.

Influence of Flowrate on Chelating Resin Capacity

Figure 15 shows concentration profiles of the effluent from two pilot test columns. One column contained a chelating resin, the other a weak acid resin. Each column treated a solution with 50 ppm cadmium and 1,000 ppm calcium chloride at pH 2.07, 4.0, and 8.0. Neither resin is effective at a pH of 2.07. The chelating resin shows approximately equal capacity at pH 4.0 and 8.0. The weak acid resin shows a capacity increase when pH is increased from 4.0 to 8.0. It is significant that the weak acid resin showed greater capacity than the chelating resin at pH 4.0 and 8.0. Where they are suitable, the less expensive weak acid resins are the resins of choice in metal removal applications.

Ion exchange polishing is often considered because hydroxide precipitation cannot effectively reduce metal solubility in the presence of compounds that form

stable complexes with the heavy metals. Ammonia, a common constituent of many plating wastewaters, tends to increase metal hydroxide solubility. For example, in a copper solution containing dissolved ammonia, the ammonia would compete for copper ions as follows:



In the presence of many chelating compounds, a chelating resin is more effective in removing heavy metals than a weak acid resin because it forms a less-ionized complex with the heavy metal ion. This effect is demonstrated in Figure 16, which shows the superiority of the chelating resin in removing copper from solutions containing ammonia. A similar situation would be expected for other complexed metal ions.

Pilot evaluations have also been performed with actual plating wastewater. Figure 17 shows the feed and effluent concentrations of copper and nickel when the effluent from a hydroxide precipitation system was treated by ion exchange polishing. After adjustment to a pH of 8.4, the wastewater still contained a high level of nickel, although copper was removed to less than 1 ppm. Dissolved ammonia content was approximately 80 ppm. The weak acid cation resin in sodium form was ineffective in removing the nickel and the test was terminated after 700 bv of solution had been treated. The chelating resin in sodium form consistently removed the nickel to levels below 0.5 ppm and the copper to below 0.1 ppm until 1,600 bv of solution had been treated. The equivalent would be processing 12,000 gal/ft³ (1,600 L/L) of resin before regeneration would be needed.

When the resin is selected for a polishing application both weak acid and chelating cation resins should be tested. The lower initial cost, greater capacity, and more efficient use of regeneration chemicals make weak acid resins the choice for those applications where they are effective in metal removal. Many wastewater applications, however, will require the chelating resins' greater affinity for heavy metals to achieve the necessary effluent quality.

Ion Exchange Wastewater Treatment Systems

The conventional practice of converting the heavy metal pollutants in metal finishing wastewater to a hydroxide sludge was thought to be a means of eliminating any environmental hazard the metals might pose. In fact, a solid waste stream is generated that, although its volume is much smaller than that of the wastewater, requires further controls to ensure that disposal of

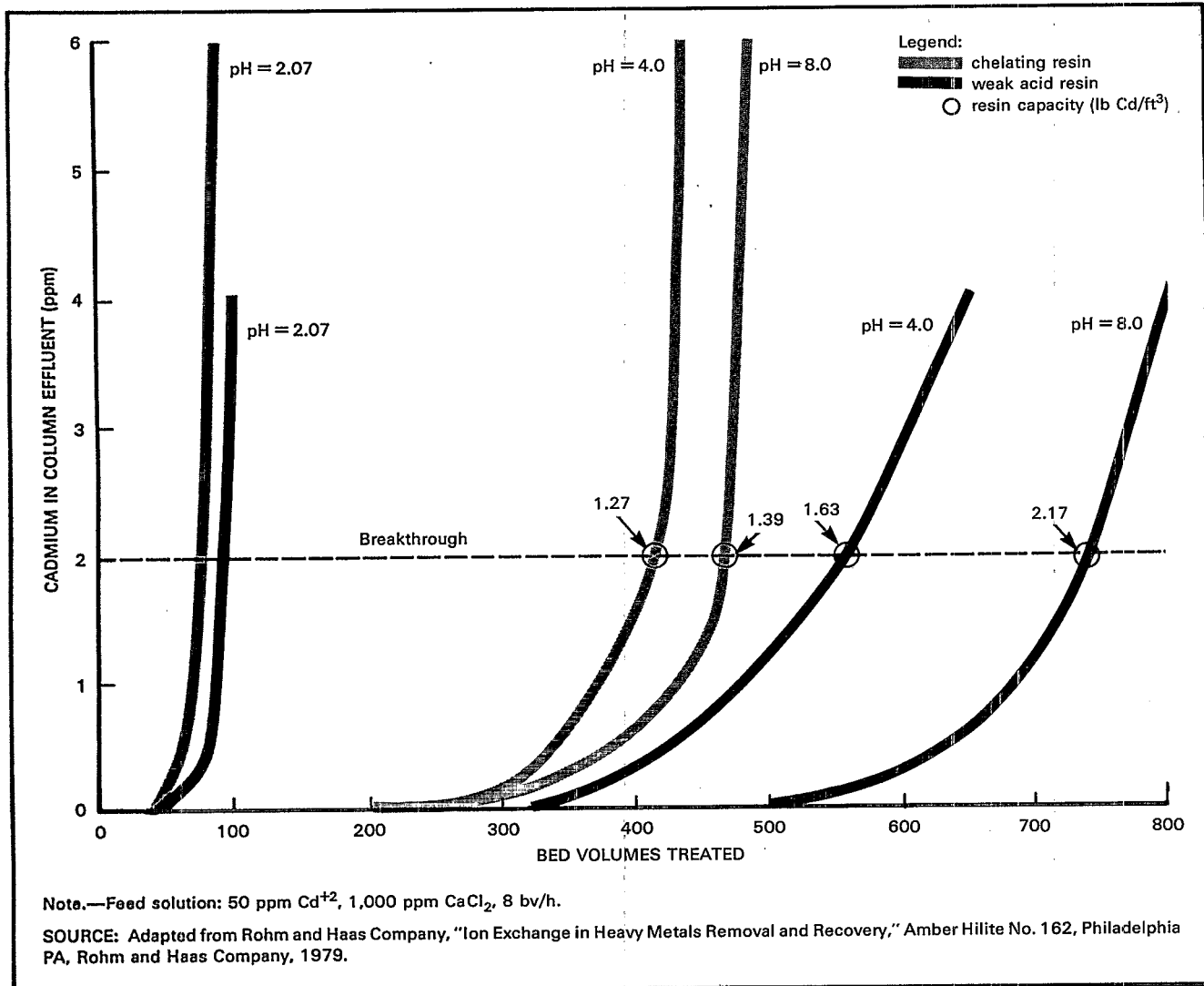


Figure 15.
Influence of Solution pH on Chelating and Weak Acid Cation Resin Capacity

the metal residue is environmentally acceptable.

Ion exchange represents an alternative means of concentrating the pollutants. The metals are concentrated in the regenerant solutions and are then in a form more easily handled and more amenable to further processing. With the increasing cost of virgin metals and the significant cost of heavy

metal waste disposal, the development of processes that recover metals from mixed metal wastes is inevitable. When metal recovery is commercialized on a wide scale, the ion exchange regenerant solutions will represent a byproduct of metal finishing operations, not a waste product.

Currently, firms using ion exchange for end-of-pipe pollution control must also install small batch treatment systems to treat the regenerant and wash solutions. These systems,

which use conventional destruct processes, result in a residue with the same disposal criteria as the sludge from a conventional treatment process. The ion exchange system may still present a less costly means of complying with pollution control regulations. The key to using ion exchange for waste treatment is to remove only the toxic pollutants while allowing most of the nontoxic ions in solution to pass through the column. Normally, the toxic compounds represent

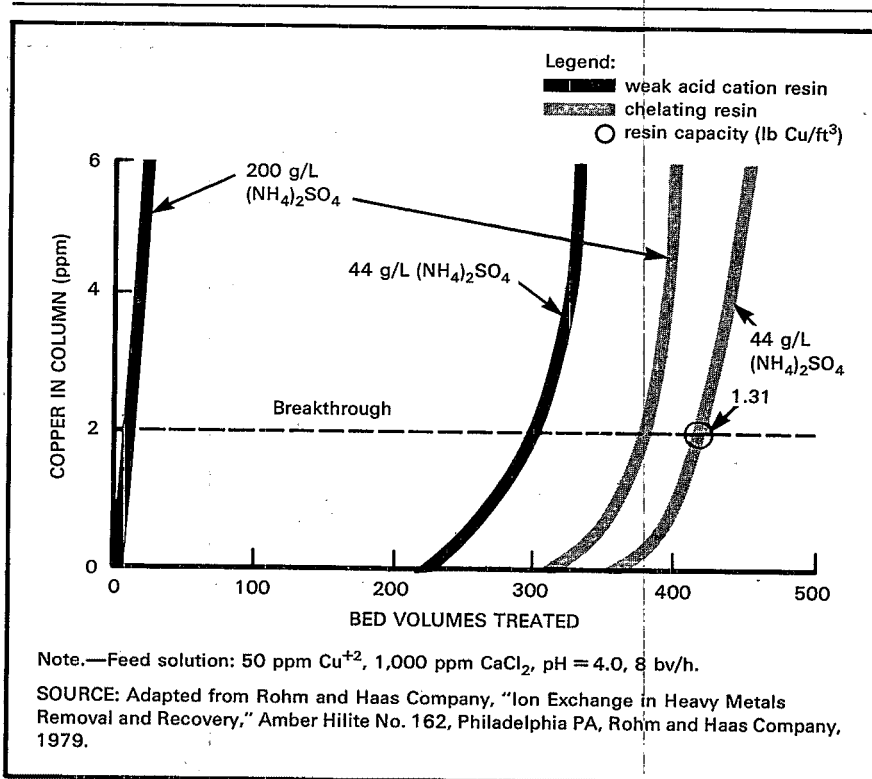


Figure 16.

Influence of Ammonia on Chelating and Weak Acid Cation Resin Capacity

only a small percentage of the ionic solids in the wastewater. If the ion exchange system is not selective in the species it removes from the wastewater, the column capacity required and the regenerant chemicals consumed will result in prohibitive costs.

Ion exchange has proved successful in selectively removing many of the pollutants encountered in metal finishing wastes. Proper application of the process requires selecting the appropriate resin and regeneration sequence and, usually, some pretreatment of the wastewater before ion exchange.

Process Description. Wastewater treatment systems employing ion exchange include the following components:

- Wastewater collection
- Wastewater pretreatment
- Ion exchange columns

- Ion exchange column regeneration system
- Batch treatment for regenerants (or waste storage if regenerants are shipped off site for treatment or recovery)

Wastewater collection most frequently consists of gravity drainage of rinses to a collection sump below ground. The sump provides a storage volume to allow the flow to the treatment system to be controlled at a constant rate. If the ion exchange columns employ either weak acid or weak base resins, the capacity and performance of the resins will be influenced by pH. Consequently, the collection sump should include coarse pH adjustment capabilities. The pH adjustment system must only ensure that the solution pH does not deviate from the broad operating range of the resin. This pH control

requirement is substantially different from those of hydroxide precipitation systems, which need minimum deviation from the control set-point.

As a rule, filtration to remove suspended solids is the only other pretreatment required. Suspended solids in the feed would hydraulically foul the resin bed. Different filters have been employed, including deep bed, diatomaceous earth precoat, and activated carbon filters. In one approach, a filter with fine resin particles is used to trap suspended solids. Regardless of the filter type, the resulting purge stream containing the suspended solids must be processed and disposed of.

The specifications of the column system containing the ion exchange resin depend on the flowrate and the pollutants in the wastewater. Two potential cases emerge with respect to pollutants:

- Heavy metal cations alone
- Heavy metal cations along with cyanides, and complex metal anions

In the case of wastewater containing only heavy metal cations, a column with the sodium form of a weak acid or heavy-metal-selective chelating cation resin would be employed. For a weak acid resin, a pH close to neutral is recommended. If a chelating resin is used, the pH can be slightly acidic (>4.0). In both cases, strongly basic conditions should be avoided because such conditions favor formation of anionic metal complexes.

For waste streams containing both heavy metals and cyanides, a stratified bed of resin has proven effective. This patented approach uses a bed of resin with successive layers of strong base anion, weak acid cation, and strong acid cation resins. The wastewater first comes in contact with the strong base resin, which selectively adsorbs the complex metal cyanide ions but

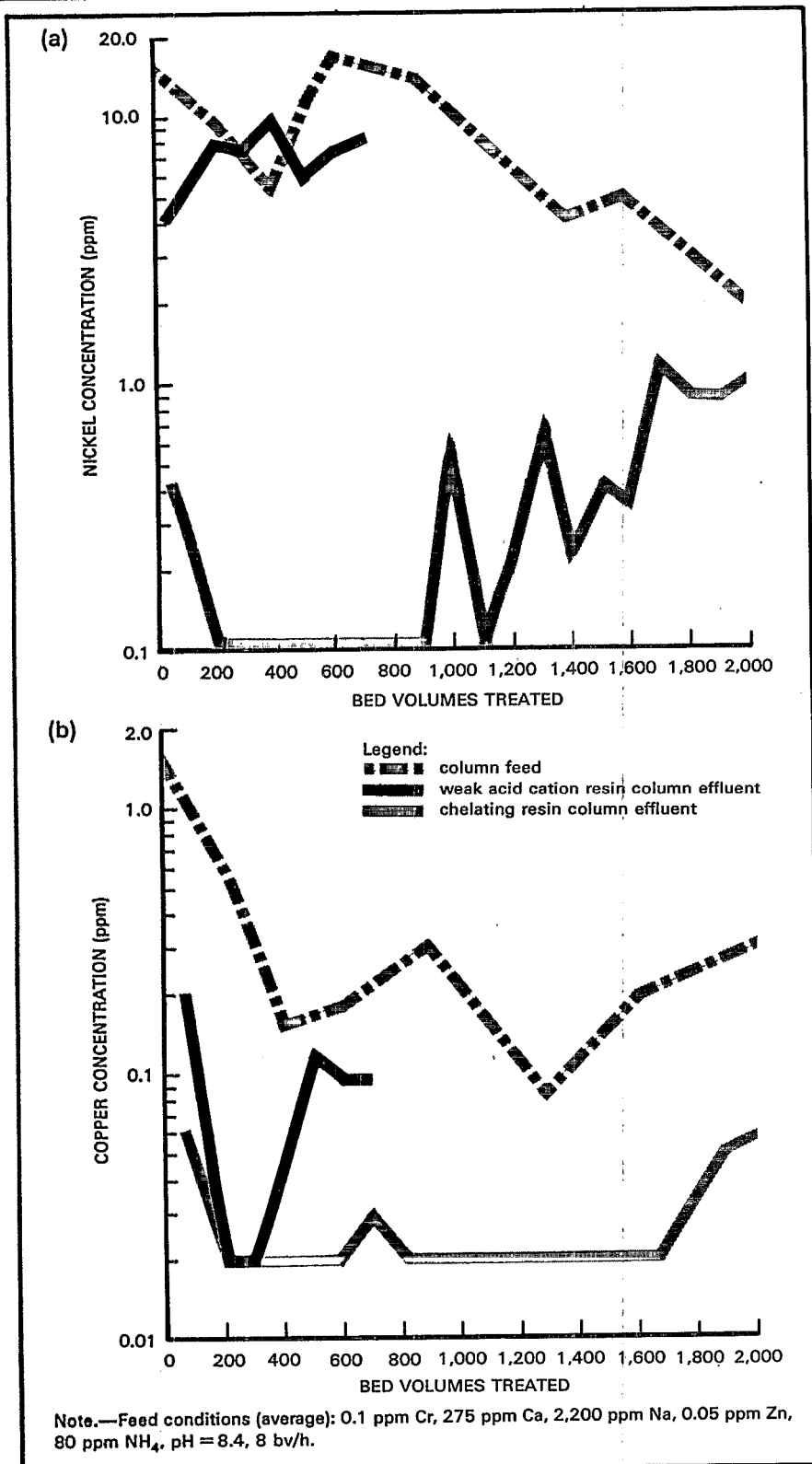


Figure 17.
Metals Removal Data: (a) Nickel and (b) Copper

allows the rest of the negatively charged ions to pass through. It should be noted that, although the resin will remove complexed metal cyanides selectively, the presence of free cyanide will result in early cyanide breakthrough. The strong base resin does not show significant selectivity for hexavalent chromium or free cyanide over the sulfate, chloride, and other non-toxic anions in a wastewater. For effective use of this type of resin system, hexavalent chromium wastes should be treated to reduce the chromium to the trivalent form before they are mixed with the rest of the wastewater. The trivalent chromium will be removed selectively by the weak acid resin.

The wastewater then comes in contact with the weak acid cation resin in the sodium form. The resin employed exhibits a strong preference for multivalent cations. Consequently, cation resin capacity is a function of the concentration of calcium, magnesium, and heavy metal cations. Finally, the resin makes contact with a layer of strong acid cation resin that is predominantly in the hydrogen form. The exchange of the hydrogen ions tends to balance the pH rise that normally would occur at the beginning of the cycle.

The system also employs a novel regeneration sequence for the stratified resin bed. In a conventional mixed bed system, cationic and anionic resins are separated by being backwashed into discrete layers. Each layer is then regenerated independently; acid is brought in contact with the cation resin and sodium hydroxide regenerates the anion bed. The bed is then mixed with air and the resin types are distributed equally throughout the bed.

With the stratified bed used for heavy metals and metal cyanide, the resin bed is first backwashed gently to remove suspended solids and the resin bed is fluidized. Because the three types of resins have

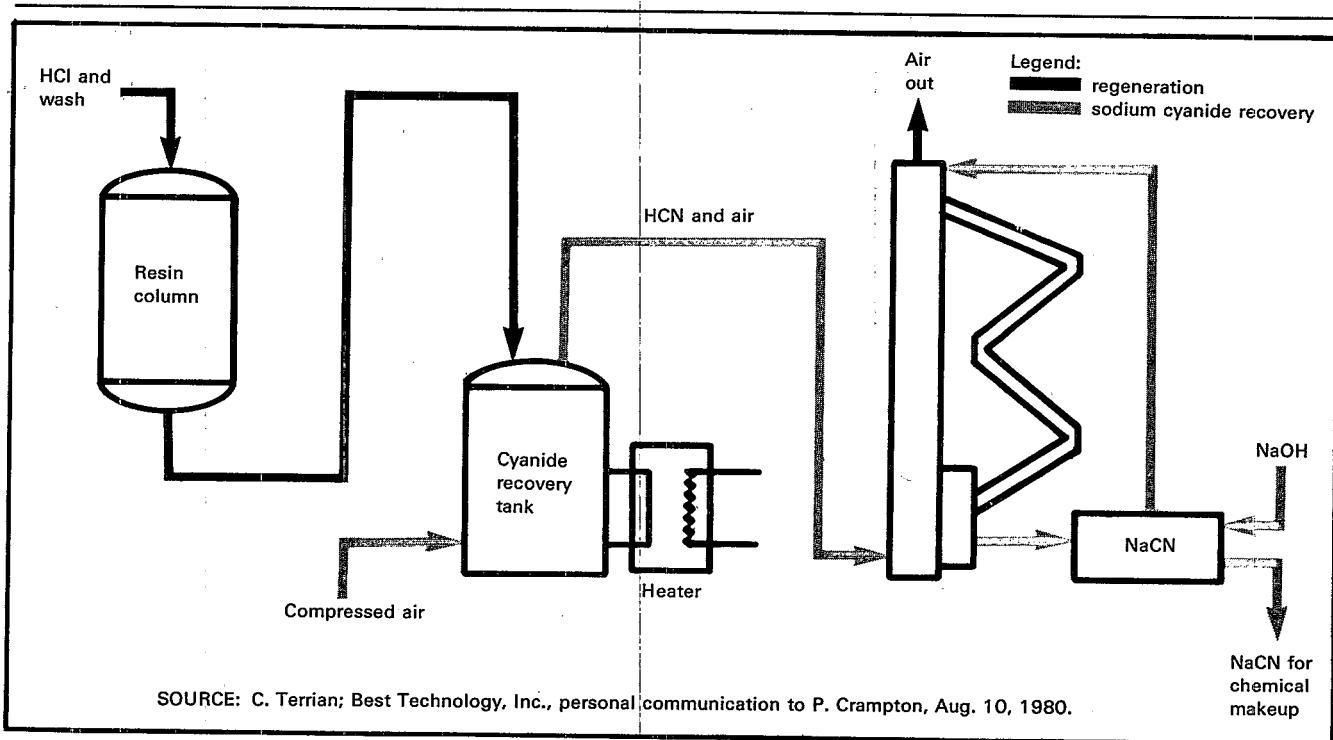


Figure 18.
Sodium Cyanide Recovery

different densities, the resin stratification can be maintained with proper backwashing. The strong base resin is least dense, the weak acid resin is intermediate, and the strong acid resin most dense. After backwash, the bed makes cocurrent contact with a 20-percent HCl solution. The acid elutes the metal cyanide complexes from the anion resin and replaces them with chloride ions. The heavy metals and divalent cations are removed from the weak acid cation resin and replaced with hydrogen ions. The strong acid resin is also converted to the hydrogen form.

After a water wash, the bed is washed with a 20-percent sodium hydroxide solution. The sodium hydroxide converts the anion resin to the hydroxide form and elutes any metal chloride complexes formed during the acid wash. The weak acid cation resin is converted to the sodium form. The sodium hydroxide is essentially depleted

by the time it reaches the strong acid resin. After another water wash, the column is returned to service.

The stratified bed system also features cyanide recovery to avoid the significant cost of treating the cyanide contained in the acid regenerant. The acid regenerant and the subsequent water wash are routed to a closed-top vessel (Figure 18) where heat is supplied to raise the solution temperature to 140° F (60° C) and air is bubbled into the solution. The result is a rapid release of HCN gas. The liberated gas is brought in contact with a caustic soda solution; the caustic soda absorbs the cyanide, yielding a sodium cyanide (NaCN) solution that can be used for chemical makeup in the cyanide plating baths.

Regenerant solutions from the ion exchange column are usually

treated in a small batch treatment system. Depending on the pollutants present, the system may need capability for cyanide oxidation, chromium reduction, and metal precipitation. The sludge resulting from batch treatment can be either settled and disposed of or mechanically dewatered before disposal.

A system treating a combined wastewater containing both ferrous ions and cyanides will have a significant concentration of ferrocyanides in the regenerant solution. These difficult-to-treat cyanide complexes result from mixing of the cyanide wastewater with acidic streams containing dissolved iron. An additional treatment step is needed to oxidize the ferrocyanides. In this step hydrogen peroxide is added to the wastewater, which is subjected to irradiation by ultraviolet light. The strong oxidizing power of this system is effective in treating the ferrocyanides.

When ion exchange column size is determined, hydraulic and contaminant loadings must be considered. Resin manufacturers recommend volumetric loading rates in the range of 1 to 2 gal/min/ft³ (0.13 to 0.26 L/min/L) of resin. Unless the contaminant loading results in unmanageable regeneration frequency, the hydraulic loading should be selected from the high end of the range.

System Performance. Operating data from ion exchange wastewater treatment systems is scarce because of the small number of facilities employing the technology; however, the available performance data indicate the potential for application in metal finishing wastewater treatment.

In one case, treatment was of a slightly acidic heavy metal wastewater containing a moderate concentration of calcium, magnesium, and sodium cations. A weak acid cation resin in the sodium form was evaluated for removing the heavy metals. The resin was able to remove both the zinc and cadmium selectively while allowing most of the calcium ions to pass through (Table 9). Initially, the resin exchanged its sodium ions for calcium ions in solution; however, the resin then exchanged these calcium ions for heavy metals. After 70 bv had been processed, the effluent contained essentially the same calcium concentration as the column feed. The column was regenerated with 3.6 percent HCl followed by conversion to the sodium form with NaOH. Table 10 shows the composition of the acid regenerant solution. In this case, ion exchange treatment reduced the waste volume associated with the pollutants to less than 5 percent of the original volume.

In a second application, an ion exchange waste treatment unit was installed to treat the combined waste flow from a plating shop performing copper, nickel, and assorted cyanide plating processes.

Table 9.Removal of Zinc and Cadmium from Wastewater by Weak Acid Cation Resin^a

Bed volume sampled	Total loading (gal/ft ³ resin)	pH	Leakage (ppm)		
			Zinc	Cadmium	Calcium
10.....	75	10.1	0.01	0.01	1
25.....	190	10.1	0.01	0.01	3
35.....	260	8.3	0.01	0.01	53
55.....	410	7.2	0.01	0.01	303
70.....	520	6.0	0.16	0.01	338
100.....	750	7.0	0.1	0.01	385
150.....	1,120	6.9	0.13	0.01	404
160.....	1,200	6.8	0.25	0.01	405
165.....	1,230	6.8	0.37	0.01	407
175.....	1,300	6.7	0.56	0.01	404
190.....	1,420	6.8	0.64	0.01	395
200.....	1,500	6.8	1.3	0.01	394
225.....	1,680	6.8	6	0.01	395

^aNa form.

Note.—Feed characteristics: 391 ppm Ca, 91 ppm Zn, 0.12 ppm Cd, 350 ppm Mg, 57 ppm Na, 3.5 ppm Mn, 0.12 ppm Ni; pH = 4.7; 8-bv/h (1-gal/min/ft³) flowrate.

SOURCE: Rohm and Haas Company, "Ion Exchange in Heavy Metals Removal and Recovery," Amber Hilite No. 162, Philadelphia PA, Rohm and Haas Company, 1979.

Table 10.

Acid Regenerant Composition

Bed volume ^a	pH	Constituent (ppm)		
		Zinc	Cadmium	Calcium
1.....	6.0	600	3.2	3,380
2.....	2.4	13,000	14	6,944
3.....	0.4	3,000	1.8	1,003
4.....	0.3	2,600	1.3	677
5.....	0.5	290	0.12	67
6.....	2.2	3.3	0.01	1.7
7.....	3.0	0.2	0.01	0
8.....	3.1	0.06	0.01	0.6
Average.....		2,440	2.6	1,500

^a3.6% HCl in bv 1 through 4; distilled water in bv 5 through 8.

SOURCE: Rohm and Haas Company, "Ion Exchange in Heavy Metals Removal and Recovery," Amber Hilite No. 162, Philadelphia PA, Rohm and Haas Company, 1979.

The entire wastewater flow was collected in a single sump equipped with a pH control system to ensure that cyanide wastes were not subjected to acidic conditions. The ion exchange columns were stratified bed units containing strong base, weak acid, and strong acid resins. Table 11 gives the waste-

water composition at various points in the treatment system and the concentration of the purge streams. Sample points are raw feed, filtered feed, filter backwash, regenerant purge, and treated effluent (see Figure 12b).

The design of the ion exchange wastewater treatment system is es-

Table 11.**Treatment of Metal Cyanide Wastewater by Ion Exchange: Pollutant Analysis**

Constituent	Content (ppm) at sample point				
	Raw feed	Filtered feed	Filter backwash	Regenerant purge	Treated effluent
Total cyanide	—	31.4	—	—	3
Cadmium	0.8	0.4	0.13	0.295	0.0001
Calcium	61.4	28.8	74.8	600	1.637
Chromium	1.37	0.52	3.47	13.4	0.356
Copper	2.11	0.28	3.8	4.57	0.41
Iron	14.2	3.3	65	11.5	0.195
Nickel	3.14	2.92	31.1	36.4	0.425
Zinc	42	23	95	251	2.62

SOURCE: C. Terrian, Best Technology, Inc., personal communication to P. Crampton, Aug. 10, 1980.

Table 12.**Commercially Demonstrated Resin Systems for Wastewater Treatment**

Resin system	Application
Weak acid	Selective removal of heavy metals from untreated wastes
Chelating cation	Selective removal of heavy metals from untreated wastes Removal of trace concentrations of heavy metals from solutions with high background cation concentrations Selective removal of heavy metals from solutions containing metal complexing compounds
Stratified bed (strong base, weak acid, strong acid)	Selective removal of metal cyanide, anionic metal complexes, and multivalent cations from solution

essentially uniform over the range of pollutant removal capabilities it exhibits. Proper resin selection, however, is the key to effective and efficient pollutant removal. Testing to verify performance of a resin system is essential before system selection. Table 12 presents varieties of resin systems in commercial use for pollution control and the pollutant removal capabilities of each.

Equipment Cost

Whether ion exchange is used to polish the effluent of an existing treatment system or whether it

is applied to treat the waste directly, the ion exchange unit is basically the same. The major equipment cost differences between the two systems is in the auxiliaries. For a polishing application after conventional treatment, the auxiliary requirements are provided by the upstream process. In a direct treatment application, however, these items add significantly to the total system cost. Determinants of the total system cost include:

- Feed pretreatment requirements
- Volumetric and contaminant loadings (resin volume needed)
- Regeneration mode
- Equipment needed to process or store regeneration solutions and purge streams

To pretreat the wastewater before it passes through the ion exchange column, suspended solids removal and coarse pH adjustment are needed; removal of organic compounds may also be required. (Fouling by organics is primarily a problem with strong base anion resins.) Organics can be removed using activated carbon or synthetic adsorbent materials. The synthetic materials have the advantage of being regenerable; spent carbon must be disposed of and replaced. As a rule, filters that remove organics are also effective for removing suspended solids.

Similarly in a polishing application the upstream process can treat the regeneration purge streams. For direct treatment, a batch destruct system is needed. Table 13 presents typical costs for the auxiliaries commonly associated with ion exchange systems.

Exchange column size and the associated resin volume specifications depend on the wastewater flowrate and the contaminant loadings. Resin manufacturers usually recommend loadings for resin systems at about 2 gal/min/ft³ (0.26 L/min/L) of resin. Flowrate indicates the flow of solution related to the average period of time it is in contact with the entire resin bed. However, the active zone of an ion exchange system can be represented as an exchange front proceeding down the column (Figure 19). The depth of the active front is a function of the volumetric loading and the speed of the ion exchange reaction kinetics. For ion exchange applications where the columns are run to exhaustion, the benefits of low loadings include greater capacity per unit of resin and more efficient use of regenerant chemicals. In wastewater treatment, however, the lack of direct measurement techniques to signal column breakthrough precludes loading the column to exhaustion, and higher loading rates are recom-

Table 13.
Typical Costs for Ion Exchange Equipment Auxiliaries

Auxiliary	Installed cost (\$)
pH adjustment tank, by flowrate in gal/min: ^a	
25.....	25,000
50.....	32,000
75.....	45,000
100.....	51,000
Deep bed sand filters, by flowrate in gal/min: ^b	
25.....	25,000
50.....	38,000
75.....	45,000
100.....	49,000
Batch treatment system, by volume in gal: ^c	
250.....	7,000
500.....	8,500
1,000.....	10,750
1,500.....	12,250
2,000.....	13,500

^a20-min retention, pH-controlled addition of NaOH, skid-mounted unit.

^bDual filters with backwash system and backwash storage, skid-mounted unit.

^cAgitated reaction tank, pH-controlled addition of H₂SO₄ and NaOH, ORP-controlled addition of NaHSO₃, manual operation.

Note.—1980 dollars.

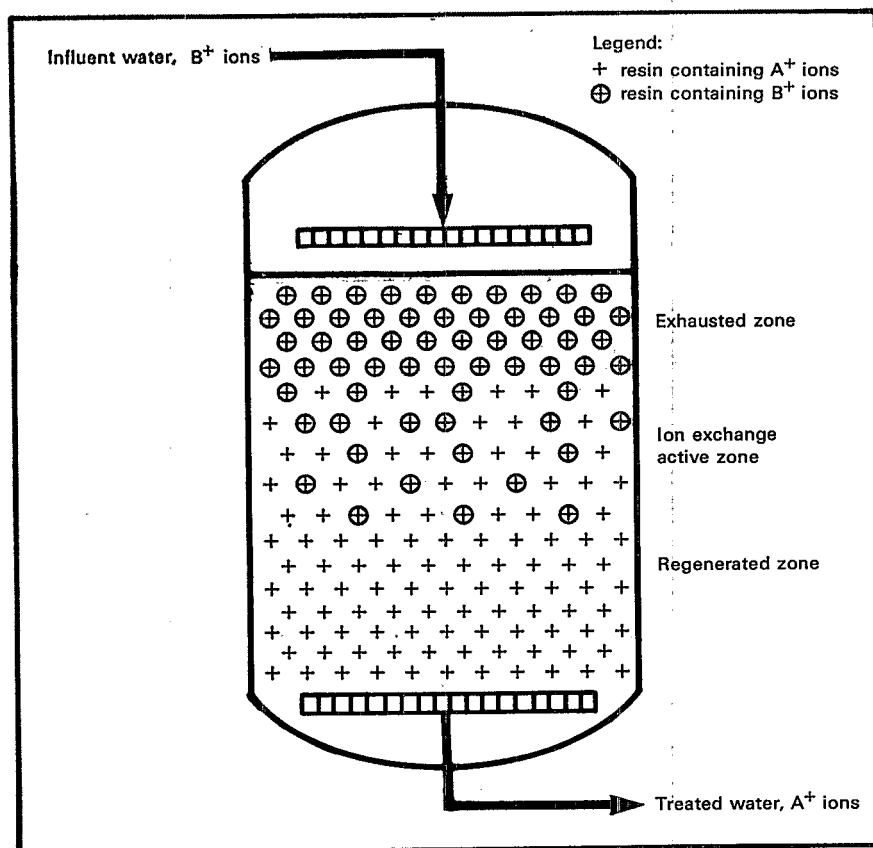


Figure 19.
Ion Exchange Column in Service

mended. Regeneration is based either on time or on cumulative volume interval. As the interval will be based on assumed wastewater concentration established by earlier testing, a safety factor must be used in determining the duration of the cycle.

The columns would typically be loaded to 75 percent of their actual capacity before regeneration. That is to say, there should usually be a band of unreacted resin left over at the end of the column on-stream cycle. For both wastewater treatment and polishing, higher volumetric loading rates, if they still result in a manageable regeneration frequency, offer the advantage of reduced equipment size and cost. Loading rates as high as 20 gal/min/ft³ (2.6 L/min/L) of cross sectional area [equal to 5 gal/min/ft³ (0.65 L/min/L) of resin volume, assuming a bed 4 ft (1.2 m) deep] have been used in some applications. High loading rates for polishing systems are particularly advantageous considering that the contaminant loading is usually low.

The regeneration sequence is labor intensive and automation is cost effective except where regeneration is needed infrequently. Regeneration of a column normally takes 1 to 2 h. As a rule, columns in multicolumn parallel flow arrangements are designed to operate at least 4 h before regeneration.

The costs for various column configurations are shown in Figure 20 for skid-mounted units that require only piping and utility connections for installation. The regenerants are metered into the units by eductors. Regeneration is manual for the single- and dual-bed units. The three-bed parallel flow unit is sized based on two columns in service while the third is being regenerated; costs are with and without automated regeneration.

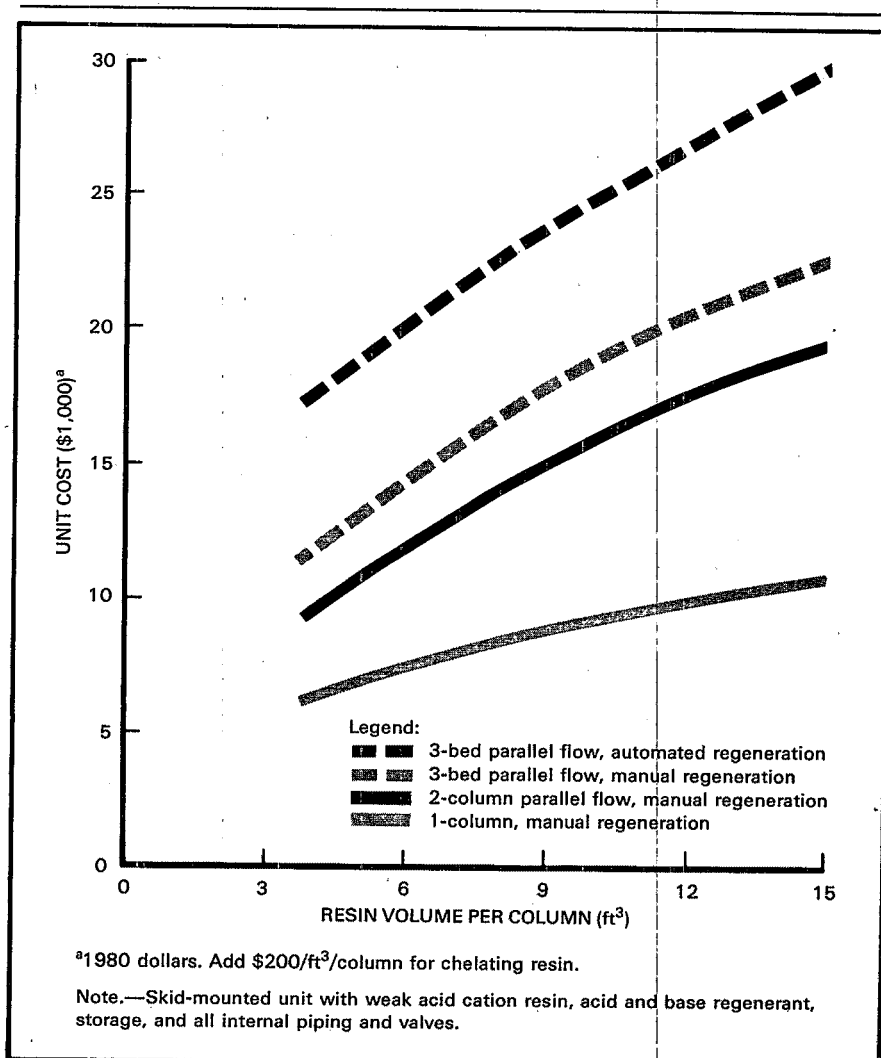


Figure 20.
Ion Exchange Unit Costs

Operating Cost

The chemical cost of operating an ion exchange system relates directly to the quantity of toxic contaminants removed from the wastewater by the resin bed. The chemical efficiency of the ion exchange reaction is a function of the resin selected and of the percentage of the resin's exchange capacity used. This relationship is

shown in Figure 21 for typical strong and weak acid cation resins over a range of acid regenerant doses. The weak acid resin requires significantly less regenerant per unit of exchange capacity.

Figure 21 also shows that the capacity of weak acid resin increases almost linearly with the amount of regenerant. That is to say, increasing the regenerant dose 50 percent increases the exchange capacity by an almost equal ratio. The strong acid resin, on the other

hand, achieves much greater chemical efficiency per unit of regenerant at lower regenerant doses. Consequently, weak acid resin systems can be designed to use the total resin exchange capacity; this capability reduces either required resin volume or regeneration frequency. Strong acid systems will realize greater efficiency if they are designed to use approximately 40 to 60 percent of the total resin exchange capacity.

Determining exchange capacity requirements requires analysis of the wastewater feed and column effluent chemical concentrations. Consider the weak acid resin system whose performance for removal of zinc and cadmium was described in Table 9. Assuming that a concentration of 1 ppm zinc in the effluent signaled the end of the cycle, 175 bv of solution could be treated before regeneration. Table 14 gives the composite feed and effluent concentrations in milligrams per liter and equivalents per liter of solution. The change in the equivalents per liter represents the number of resin exchange sites that would be exhausted if 1 L of solution were passed through the exchange column. The test indicated that each liter of solution treated would exhaust 0.0145 eq of resin exchange capacity. Breakthrough occurred after 175 bv had been treated, indicating that the resin had a total capacity of 2.5 eq/L, which is the same as the resin manufacturer's data indicated.

Assuming a three-column parallel flow unit is selected to treat the 50-gal/min (190-L/min) waste stream and that the columns are operated on a 4-h cycle, the necessary column size can be determined. It is assumed that the resin capacity is actually 80 percent of the theoretical capacity. This adjustment is similar to applying a fouling coefficient to a heat transfer surface and accounts for gradual

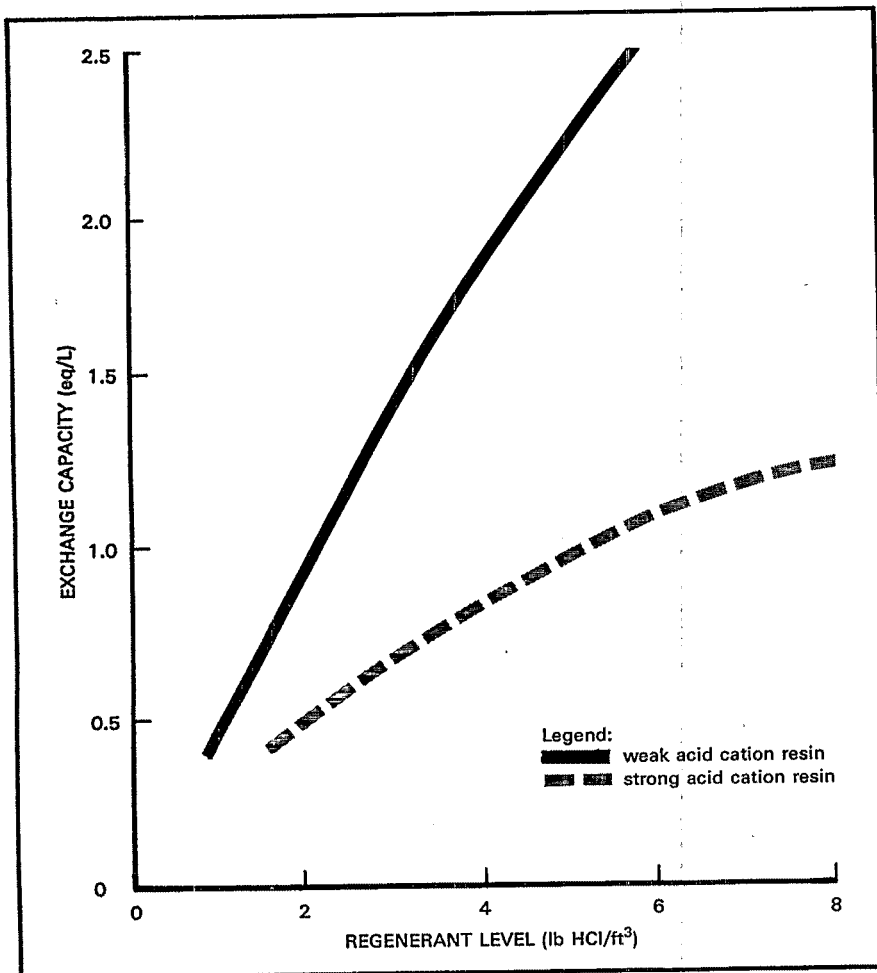


Figure 21.
Exchange Capacity versus Acid Regenerant Load for Cation Resins

Table 14.
Resin Capacity Based on Test Results

Constituent	Feed		Product		Change (eq/L)
	g/L	eq/L	g/L	eq/L	
Calcium	0.39	0.0195	0.3	0.015	0.0045
Magnesium	0.35	0.0292	0.27	0.0225	0.0067
Zinc	0.09	0.0028	(^a)	(^a)	0.0028
Sodium	0.06	0.0026	0.32	0.0139	-0.0113
Manganese	0.03	0.001	0.02	0.0006	0.0004
Cadmium	0.001	(^a)	(^a)	(^a)	0.0001

^aNegligible.

Note.—Exchange requirements: per liter of feed, 0.0145 eq/L; per 175 bv of feed, 2.53 eq/L of resin.

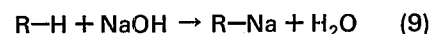
deterioration in resin performance. The adjustment yields a resin capacity of 2 eq/L.

The resin volume requirement calculation per column is shown in Table 15. The unit is designed to have two of the three columns on stream at any time. Assuming that the column is run to exhaustion, 5.8 ft³ (164 L) of resin would be needed per column.

No direct indication of column breakthrough is available for end-of-pipe process applications. To prevent discharging high concentrations of regulated pollutants, the columns can only be operated to some fraction of their actual capacity; 75 percent is a reasonable safety factor. Required resin volume would then increase to 7.8 ft³ (220 L) per column.

Two safety factors, then, have been used in sizing the ion exchange system; one to compensate for a gradual deterioration of resin exchange capacity and one to compensate for lack of direct means of determining column breakthrough.

Table 15 shows regeneration chemical consumption and cost, the purge streams from the unit, and the waste concentration factor. The purge stream containing the pollutants is approximately 7 percent of the original volume of wastewater. Consumption of HCl and NaOH for the system was assumed at 120 percent of the stoichiometric reagent requirement, based on the theoretical resin exchange capacity of 2.5 eq/L. Sodium hydroxide needs are only slightly above stoichiometric amounts, despite the resin's preference for being in the hydrogen form, because the product of the caustic regeneration reaction is not ionized. The caustic regeneration reaction is:



Once the resin's hydrogen ion is exchanged, it combines with a

Table 15.
Column Size Determination for Three-Column Parallel Flow Unit

Item	Factor
Flowrate:	
Per column	25 gal/min
Total	50 gal/min
Column cycle	4 h
Exchange capacity per liter of feed	0.0145 eq
Capacity needed per column	$4 \times 60 \times 25 \times 3.79 \times 0.0145 = 330 \text{ eq}$
Resin volume needed:	
Per column	$[330/(2 \text{ eq/L})] \times [1/(3.79)(7.48)] = 5.8 \text{ ft}^3$
With safety factor	$5.8/0.75 = 7.8 \text{ ft}^3$
Regenerant consumption per column per cycle:	
HCl (based on 100%)	45 lb
NaOH (based on 100%)	50 lb
Wash water	390 gal
Cost per cycle ^a	\$15.09
Waste concentration factor	$(6,000 \text{ gal wastewater per cycle})/(400 \text{ gal purge per cycle}) = 15$

^a1980 dollars.

Table 16.
Annual Cost of Ion Exchange Treatment System

Item	Cost
Investment (\$).	23,000
Operating cost (\$/yr):	
Labor, ½ h/shift at \$8/h	2,000
Maintenance, 6% of investment	1,400
Regenerant chemicals, 4,000 h at 2 h/cycle	30,180
Total operating cost	33,580
Fixed cost (\$/yr):	
Depreciation	2,300
Taxes and insurance	230
Total fixed cost	2,530
Total annual cost	36,110

Note.—1980 dollars. Operation 4,000 h/yr. Does not include water pretreatment or batch treatment system.

hydroxide ion to form a non-ionized water molecule and no longer competes for exchange sites.

The installed cost of a three-column parallel flow ion exchange system with 7.8 ft³ (220 L) of resin per column, skid-mounted with automated regeneration, is \$23,000 (Figure 20). Table 16 shows the total annual cost for a system operating 4,000 h/yr. Capital and operating costs of wastewater pre-

treatment and batch treatment are not included.

A similar analysis can be performed for a polishing system using performance data from Figure 17 and a flowrate of 50 gal/min (190 L/min). The major difference is in the large volume of solution that can be treated per unit volume of resin. In the direct treatment case, 175 bv could be treated before

resin exhaustion; for the polishing system (Figure 17) breakthrough does not occur until 1,600 bv of wastewater have been treated.

The longer column cycle associated with polishing often eliminates the justification for automated regeneration. If regeneration is manual, a two-column unit, operated in either parallel or series flow with each column sized to process the total flow, would probably be most effective in terms of regeneration frequency and reliability. For automated units, a three-column parallel flow unit, designed to have one column off stream for regeneration, would probably be most effective.

Safety features similar to those used in the direct treatment analysis will be applied to the polishing system. The theoretical capacity will be reduced to 80 percent of the capacity indicated in the test data to compensate for fouling, and the column will be exhausted to only 75 percent of its actual capacity to avoid breakthrough before regeneration. These features will yield a volume-processing capability of 960 bv of wastewater before regeneration.

Regeneration frequency is a function of column size. Table 17 gives regeneration frequencies, costs per regeneration cycle, and annual costs for units in three sizes, each operating 4,000 h/yr. Operating time for each regeneration cycle was assumed at 1 h. Operating costs are approximately the same for all three units, and would therefore favor the smaller unit, which requires the least capital outlay. The chemical cost for a polishing system is significantly lower than that for the direct treatment system (Table 16) because most of the metals are removed during conventional treatment.

Evaluating resin capacity by running a test column to exhaustion (Figure 17), is time consuming, particularly for a polishing application

Table 17.
Annual Cost for Ion Exchange Polishing Systems

Item	Regeneration frequency		
	16 h	24 h	36 h
Column resin volume (ft ³) ^a	6.7	10.0	15.0
Ion exchange unit cost (\$).	15,700	19,000	24,000
Operating costs (\$/yr):			
Labor, at \$8/h ^b	2,000	1,330	890
Maintenance, at 6% of unit cost.....	780	900	1,140
Regeneration chemicals ^c	1,660	1,660	1,660
Total operating cost.....	4,440	3,890	3,690
Fixed costs (\$/yr):			
Depreciation.....	1,570	1,900	2,400
Taxes and insurance.....	160	190	240
Total fixed cost.....	1,730	2,090	2,640
Total annual cost.....	6,170	5,980	6,330

^aFor chelating resin column. 50-gal/min flowrate.

^b1 h labor per regeneration.

^cBased on 120% theoretical resin capacity = 1 eq/L.

Note.—1980 dollars. Systems operating 4,000 h/yr.

where the resin can process a large volume of solution before exhaustion. It is more expedient to pass only sufficient volume through the column until the column effluent reaches equilibrium, then analyze the feed and product for ionic constituents. The exchange per unit of feed solution will thus be determined and, when compared to the resin's theoretical exchange capacity (from manufacturer's literature), can be used to predict the solution volume the resin can process before exhaustion. The safety factors described earlier should be used with this approach.

The foregoing, then, are some of the alternatives and process variables to be considered in evaluating ion exchange systems. Actual testing, decisions regarding system specification, and type of resin should be left to experts in use of the technology. An awareness of the flexibility and power of the ion exchange process for waste treatment applications, however, can aid the metal finisher in obtaining the most effective system for the least total cost.

Chemical Recovery and Recycle Systems

Pollution control legislation has affected industry by increasing the economic penalty associated with inefficient use of raw materials. In the plating industry, for example, loss of raw material in the wastewater can result in costs in three distinct areas:

- Replacement of the material
- Removal of the material from the wastewater before discharge
- Disposal of the solid waste residue

In response to the increased cost of raw materials, plating shops are modifying their processes to reduce their losses. Recent years also have seen the cost-effective application of various separation processes that reclaim plating chemicals from rinse waters, permitting reuse of both the raw material and the water.

Ion exchange, evaporation, reverse osmosis, and electrodialysis have all been used in the plating industry to recover chemicals from rinse solutions. These processes have in common the ability to separate specific compounds from a water solution, yielding a concentrate of those compounds and relatively pure water. The concentrate is recycled to the plating bath and the purified water is reused for rinsing. To determine which separation process is best suited for a particular chemical recovery application, it is usually necessary to evaluate both general and site-specific factors, for example:

- General factors would include rinse water concentration, volume, and corrosivity.
- Among site-specific factors are floor space available, utilities (such as steam, chemical reagents, electricity) available, and degree of concentration needed to recycle the chemicals to the bath.

As a rule, ion exchange systems are suitable for chemical recovery when the rinse water feed has a relatively dilute concentration of

plating chemicals and the degree of concentration needed for recycle is not great. Ion exchange is well suited for processing corrosive solutions. The process has been demonstrated commercially for chemical recovery from acid copper, acid zinc, nickel, cobalt, tin, and chromium plating baths. It has also been used to recover spent acid solutions and for purifying plating solutions to prolong their service life.

Economic Analysis of Recovery Systems

To evaluate the economic benefit of installing ion exchange or other recovery processes, the following determination must be made:

- Quantity and replacement cost of the chemicals and water to be recovered
- Savings in wastewater treatment cost expected to result from recovery unit installation
- Reduction in solid waste and cost of sludge disposal expected to result from recovery unit installation

In evaluating a plating chemical drag-out recovery system, the rinse water volume and chemical concentration must first be measured. This step will establish the quantity of chemicals available for recovery. When the relationships of wastewater volume and metal content to the associated wastewater treatment and sludge disposal cost have been determined, the potential savings can be determined. Table 18 shows the economic penalties for losses of typical plating chemicals.

The high investment cost for installing an automated recovery process limits application of this process to plating operations with high drag-out rates, as illustrated for chromic acid recovery in Figure 22. The analysis assumed an

Table 18.
Economic Penalty for Losses of Plating Chemicals

Chemical	Cost (\$/lb)			
	Replacement	Treatment ^a	Disposal ^b	Total
Nickel:				
As NiSO ₄	0.84	0.31	0.38	1.53
As NiCl ₂	1.14	0.34	0.52	2.00
Zinc cyanide, as Zn(CN)₂:				
Using Cl ₂ for cyanide oxidation.....	1.55	0.80	0.50	2.85
Using NaOCl for cyanide oxidation...	1.55	1.68	0.50	3.73
Chromic acid, as H₂CrO₄:				
Using SO ₂ for chromium reduction...	0.98	0.53	0.64	2.15
Using NaHSO ₃ for chromium reduction.....	0.98	0.76	0.64	2.38
Copper cyanide, as Cu(CN)₂:				
Using Cl ₂ for cyanide oxidation.....	2.05	0.80	0.50	3.35
Using NaOCl for cyanide oxidation...	2.05	1.68	0.50	4.23
Copper sulfate, as CuSO₄.....	0.62	0.31	0.34	1.27

^aAt concentration of 100 mg/L in wastewater.

^b4% solids by weight at \$0.20/gal.

Note.—1980 dollars.

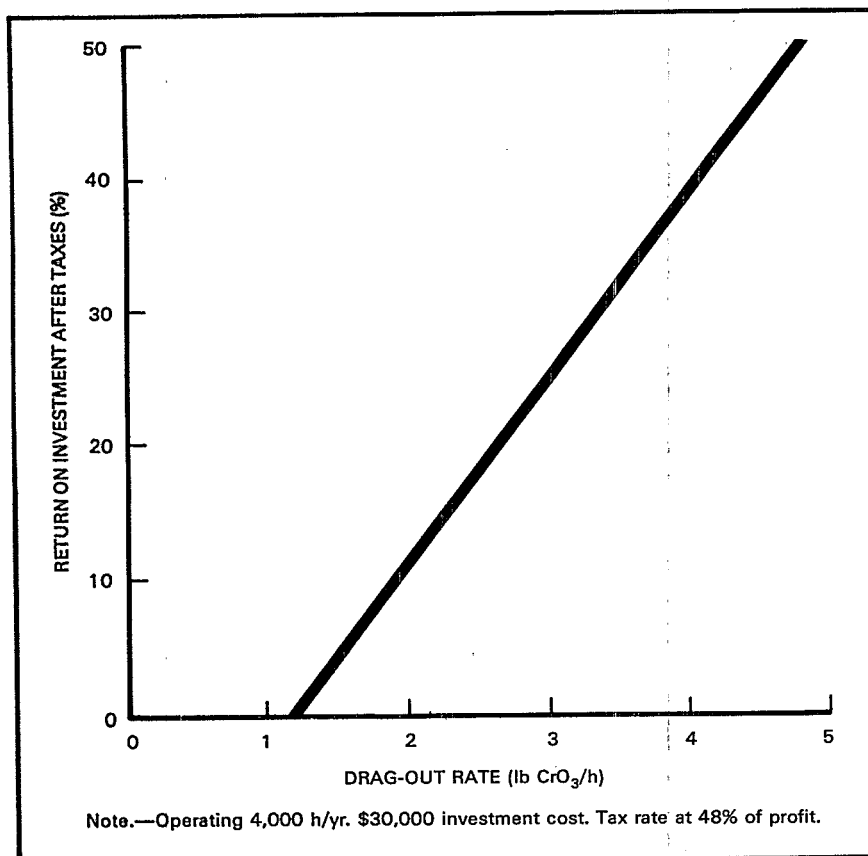


Figure 22.
Return on Investment in Chromic Acid Recovery Unit

investment cost for the recovery system of \$30,000, with the unit depreciated over 10 years. Typical operating, labor, and maintenance costs for an ion exchange system were used to determine operating costs. Chemical savings were derived from Table 18, which indicated a total saving of \$2.15/lb of H₂CrO₄ recovered (equal to \$2.50/lb of CrO₃). From the foregoing, a reasonable rate of return is achieved for a CrO₃ drag-out rate above 3 lb/h (1.4 kg/h), for which payback equals 2.8 years. Plating operations with rates significantly lower than 3 lb/h (1.4 kg/h) would not be economically justified in installing this recovery system.

Tax credits associated with investments in pollution control hardware were not included in the foregoing analysis. The credits would improve the economy of otherwise marginal investments, but not enough to justify installing an automated recovery system in an operation with low drag-out rates.

Drag-Out Recovery by Ion Exchange

The Reciprocating Flow Ion Exchanger (RFIE) is the kind of ion exchange system most widely used for chemical recovery from plating rinses. This proprietary unit was especially developed for purifying the bleed stream of a large volume solution such as the overflow from a plating rinse tank. It operates on the principle that, for the short period of time the unit goes off stream for regeneration, the buildup of contaminants in the rinse system is negligible.

The RFIE units are more attractive than fixed bed systems for plating chemical recovery because the columns use smaller resin volumes and, therefore, capital costs and space requirements are usually lower. The units incorporate regenerant chemical reuse techniques to reduce operating costs and

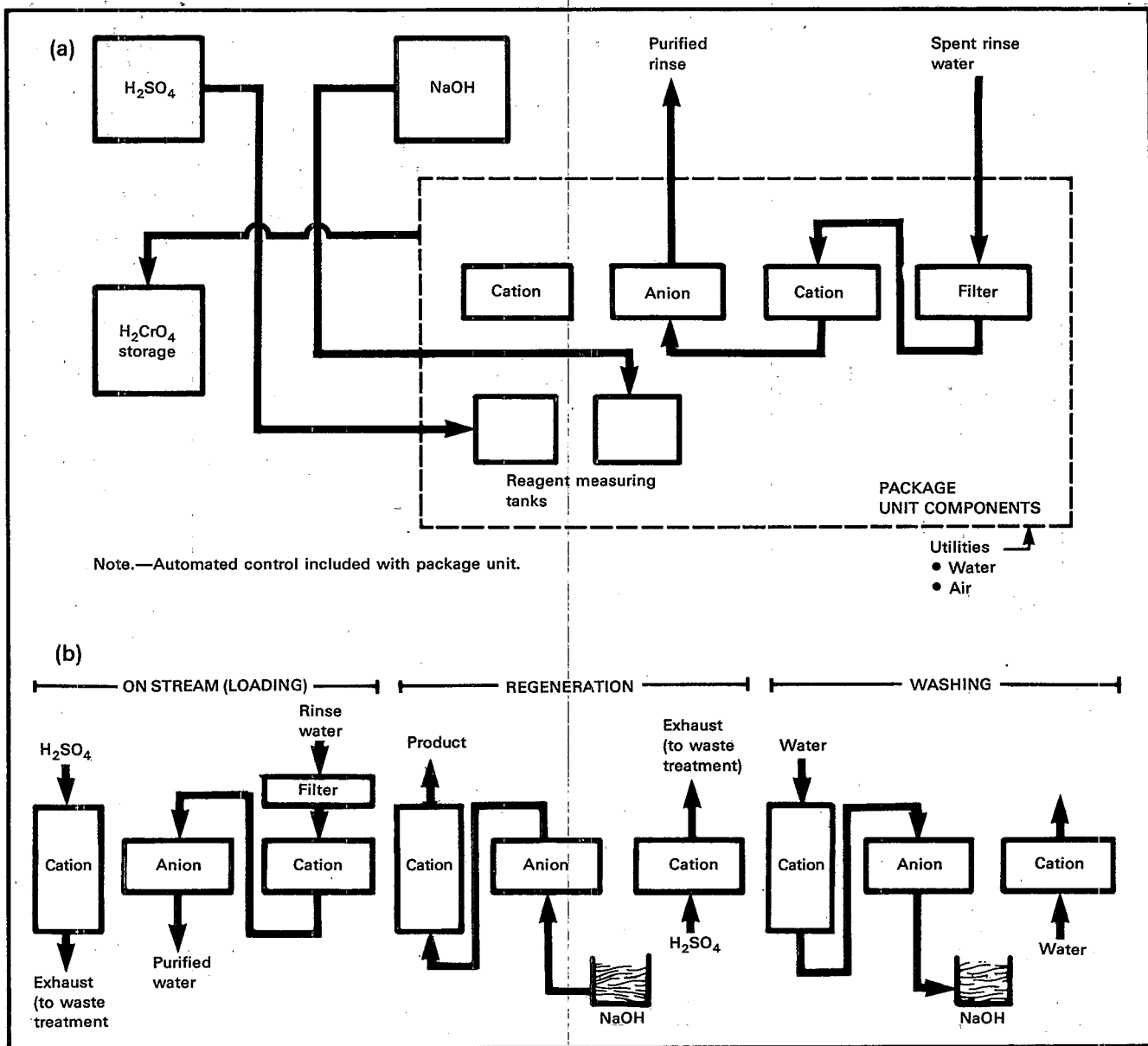


Figure 23.

Chromic Acid Recovery RFIE System: (a) Hardware Components and (b) Operating Cycle

yield higher product concentration for recycle. They are sold as skid-mounted package units, which are automated to minimize operating labor requirements. Two basic units are available for drag-out recovery: one for chromic acid recovery and one for metal salt recovery. Another unit is designed to deionize mixed-metal rinse solutions to

recover only the water and concentrate the metals before treatment.

Chromic Acid. Figure 23 shows the hardware components of an RFIE chromic acid recovery system and necessary auxiliaries and describes the operating cycle. The segregated rinse water after a

chromium plating bath (or baths) is pumped to the ion exchange unit and passes in series through a cartridge filter, a strong acid cation resin bed, and a strong base anion bed. The demineralized water is returned to the rinse system. The RFIE unit regenerates itself automatically based either on a cycle timer or on the conductivity of the treated water. With the conduc-

tivity controller, the conductivity of the treated water is compared with that of the unit feed. When the unit is no longer achieving sufficient conductivity reduction, regeneration is initiated. Regeneration frequency is based on the quantity of chromic acid in the rinse and the unit's resin volume. The unit is off stream for regeneration for approximately 20 min. The chromate ions removed from the rinse are concentrated in the anion resin bed. They are eluted in the form of a sodium chromate solution when this bed is regenerated with sodium hydroxide. The sodium chromate solution is passed through a second strong acid cation resin bed to convert the sodium chromate to chromic acid. The recovered chromic acid solution is stored and used for chemical makeup in the chromium plating bath. The product concentration is approximately 10 percent chromic acid. After the resin beds are washed with water, the unit goes back on stream.

The RFIE units come in several sizes; higher chromic acid loading rates require larger resin bed volume. Ideally, the unit performs two cycles per hour. Each cycle reclaims a certain amount of chromic acid and consumes a set amount of regenerant chemicals. Table 19 shows the chemical savings, reagent cost, and amount of chromium recovered per cycle.

Figure 24a presents the purchase cost of RFIE units for chromic acid recovery as a function of the amount of chromic acid the unit can recover. Including reagent and product storage, piping and utility connections, startup, and shipping expenses, the total installed cost for a system should be approximately 120 percent of the unit cost.

Metal Salts. RFIE units are recovering plating drag-out from nickel, copper, zinc, tin, and cobalt plating rinses. The major area of application is for nickel plating baths. Two basic units are used for metal

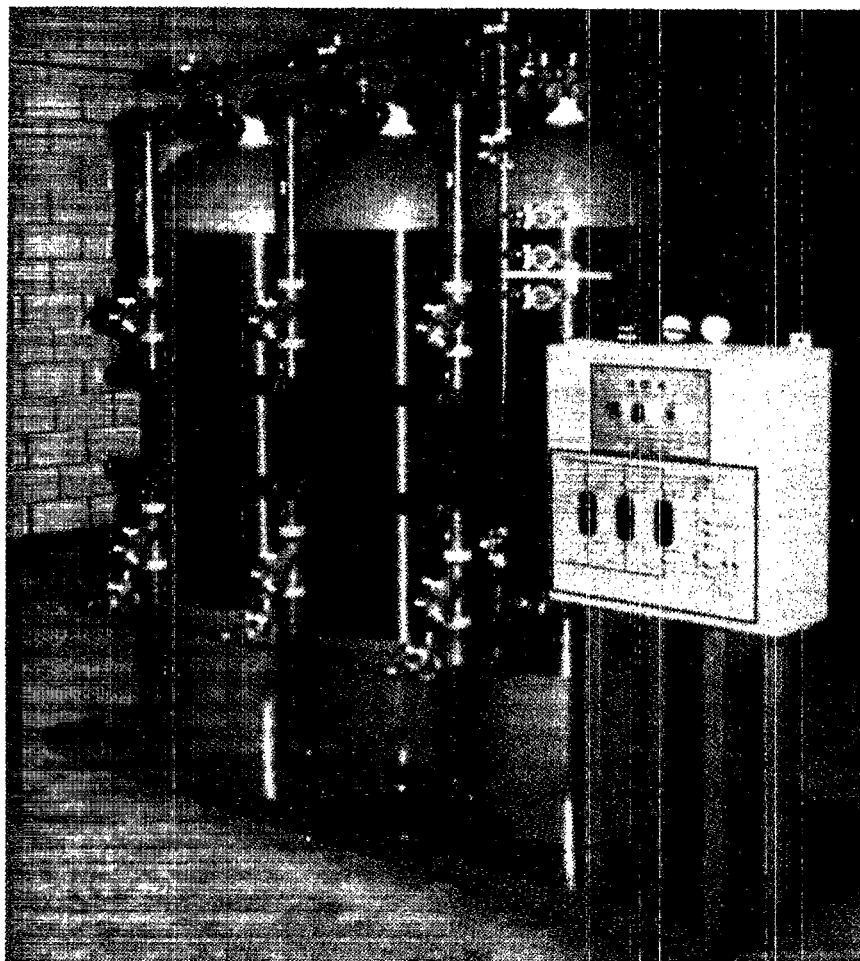
Table 19.

Performance of RFIE Chromic Acid Recovery Unit^a

Item	Value (per cycle)
Regenerant solutions:	
NaOH	3.7 lb
H ₂ SO ₄	12.2 lb
Water	80 gal
Spent rinse	1,200 gal/cycle; 200 ppm CrO ₃
Purified rinse	1,200 gal/cycle
Product, CrO ₃	2 lb each at 10% CrO ₃
Purge to waste treatment	80 gal
Chemical savings (\$): ^b	
CrO ₃ , 2 lb at \$2.50/lb	5.00
NaOH at \$0.15/lb	-0.56
H ₂ SO ₄ at \$0.05/lb	-0.61
Total saving per cycle	3.83

^a0.35 ft³ anion resin.

^b1980 dollars.



Three-column parallel-flow ion exchange package unit ready for installation

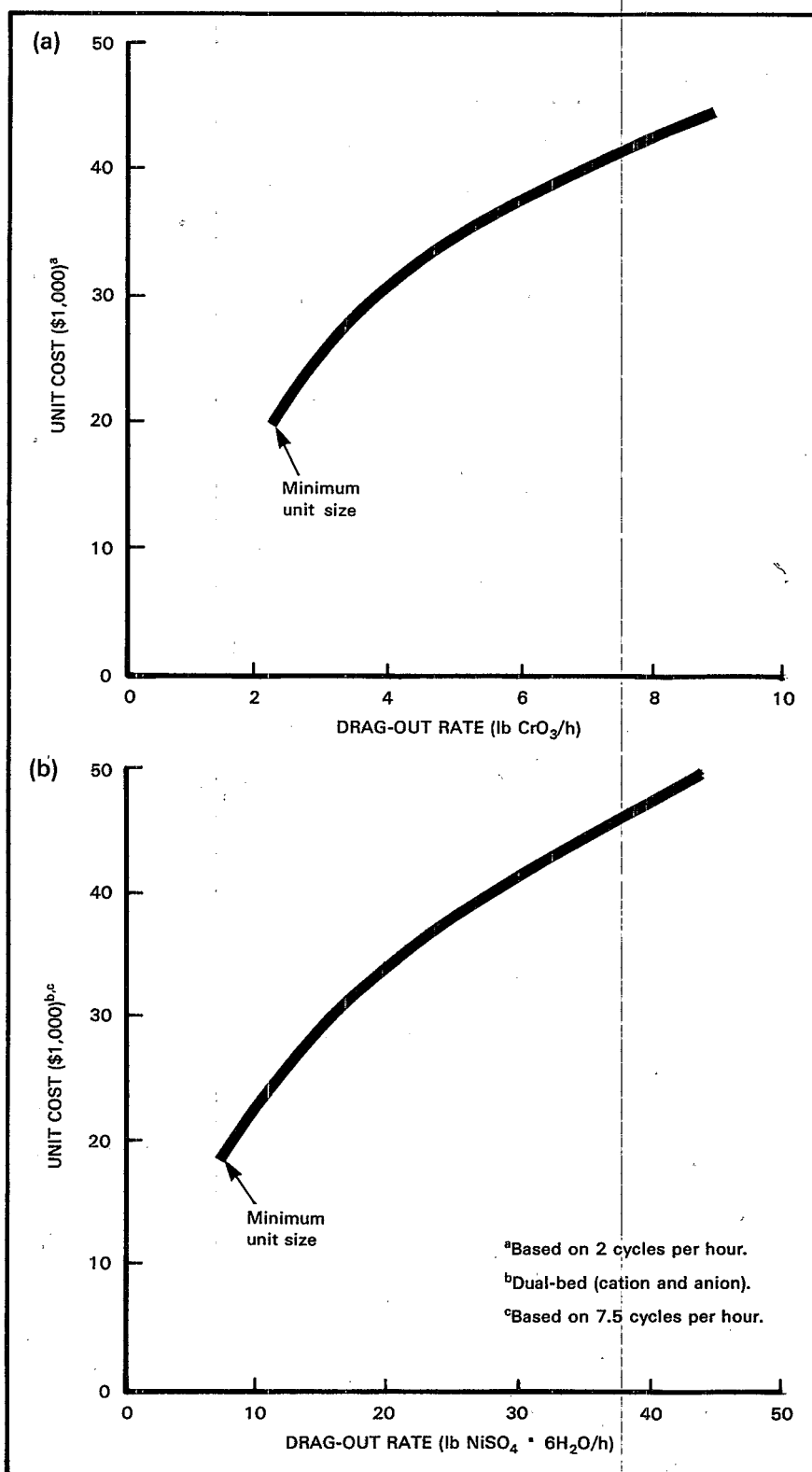


Figure 24.
 Equipment Cost of RFIE Units: (a) Chromic Acid Recovery and
 (b) Metal Salt Recovery

recovery. One employs a cation bed to reclaim the metal ions and an anion bed to remove the counterions; the deionized water is recycled to the rinse station. For applications where only recovery of the metal is desired, the anion bed is eliminated and the metal-free water is discharged.

Figure 25 presents RFIE system hardware and the necessary auxiliaries for metal salt and rinse water recovery and describes the operating cycle. The segregated rinse water after the plating bath (or baths) is pumped to the ion exchange unit and passed, in series, through a prefilter, a strong acid cation resin bed, and a strong base anion bed. The demineralized water is returned to the rinse system. The metal ions concentrate on the cation resin and are eluted with either sulfuric or hydrochloric acid. The concentrated salt solution (either the metal sulfate or chloride) is stored and used for chemical makeup in the plating bath. The regenerant from the anion bed is sent to waste treatment.

Metal salt recovery units also come in various sizes, with unit size determined by the amount of metal salts in the rinse water. Each cycle will reclaim a set amount of metal salts and consume a set amount of regenerant chemical. Table 20 shows chemical savings, reagent consumption, and the amount of metal recovered per cycle for nickel plating recovery.

The purchase cost for an RFIE metal salt recovery unit is presented in Figure 24b as a function of the amount of metal salts the unit can recover. The price is for a unit with both a cation and an anion bed; the price is approximately one-third less for a unit with a single cation bed. Including the basic RFIE unit, reagent and product storage, piping and utility connections, start-up, and shipping, the total installed

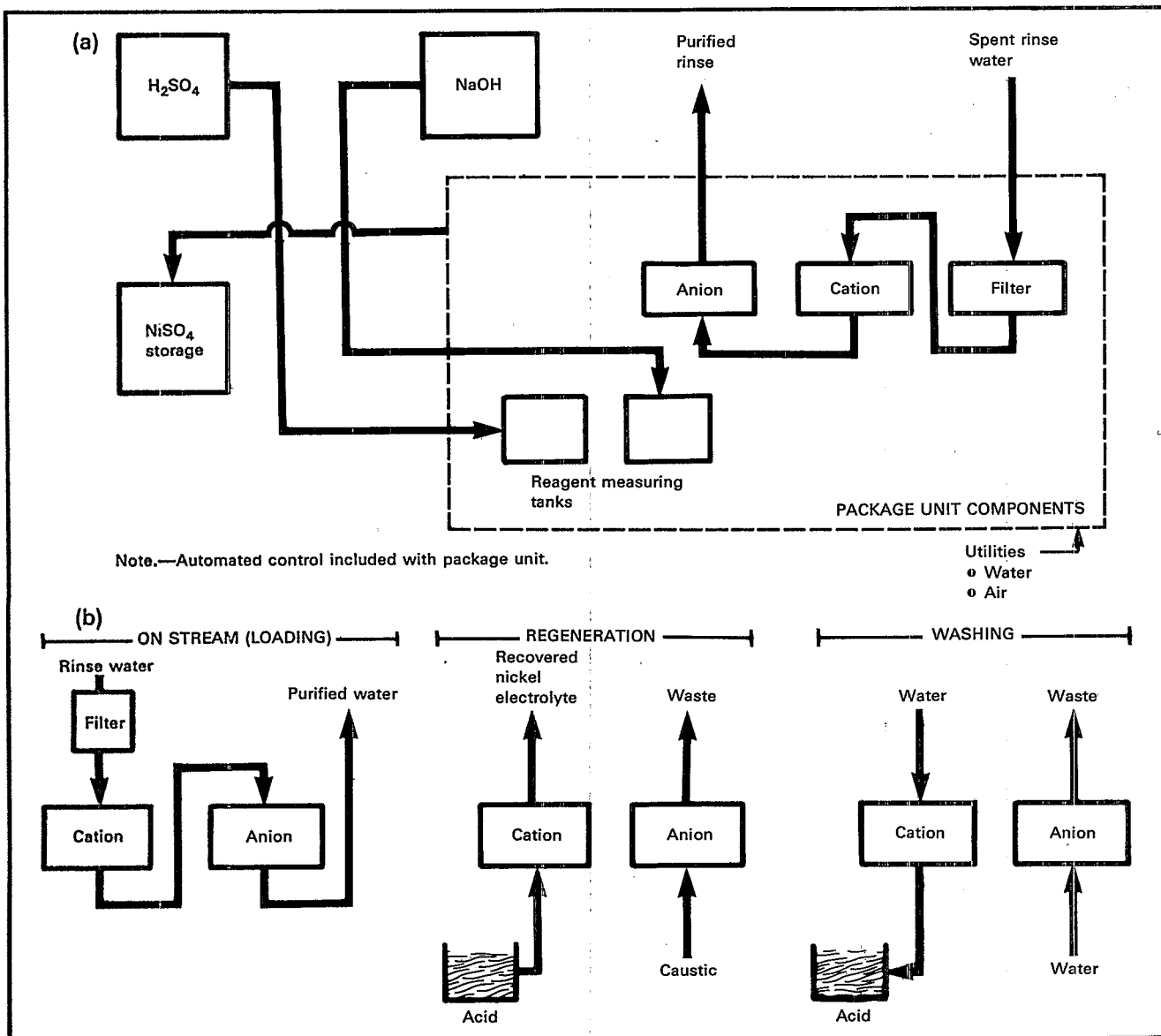


Figure 25.

Metal Salt Recovery RFIE System: (a) Hardware Components and (b) Operating Cycle

cost for a recovery system should be 120 percent of the unit cost.

Acid Recovery Systems

Ion exchange is used to purify concentrated acids (such as sulfuric, hydrochloric, and nitric) that have

been contaminated by metal salts. The process, called acid retardation, brings an acid solution in contact with a strong base anion resin. The resin will sorb the strong acid but not the metal salts. The acid can

be desorbed with water. This technique has been commercialized using reciprocating flow methods similar to those described for chemical recovery.

The two process steps are shown in Figure 26. In the on-stream step (upstroke), the metal-

Table 20.
Performance of RFIE Metal Salt Recovery Unit^a

Item	Value (per cycle)
Regenerant solutions:	
NaOH.....	0.63 lb
H ₂ SO ₄	1.2 lb
Water.....	58 gal
Spent rinse.....	250 gal/cycle; 600 ppm NiSO ₄ • 6H ₂ O, 150 ppm NiCl • 6H ₂ O
Purified rinse.....	250 gal/cycle
Product, NiSO ₄ • 6H ₂ O.....	1.7 lb each at 17% NiSO ₄ • 6H ₂ O
Purge to waste treatment.....	58 gal
Chemical savings (\$):^b	
Anhydrous NiSO ₄ , 1 lb at \$1.53/lb.....	1.53
NaOH at \$0.15/lb.....	-0.09
H ₂ SO ₄ at \$0.05/lb.....	-0.06
Total savings per cycle.....	1.38

^a0.35 ft³ cation resin.

^b1980 dollars.

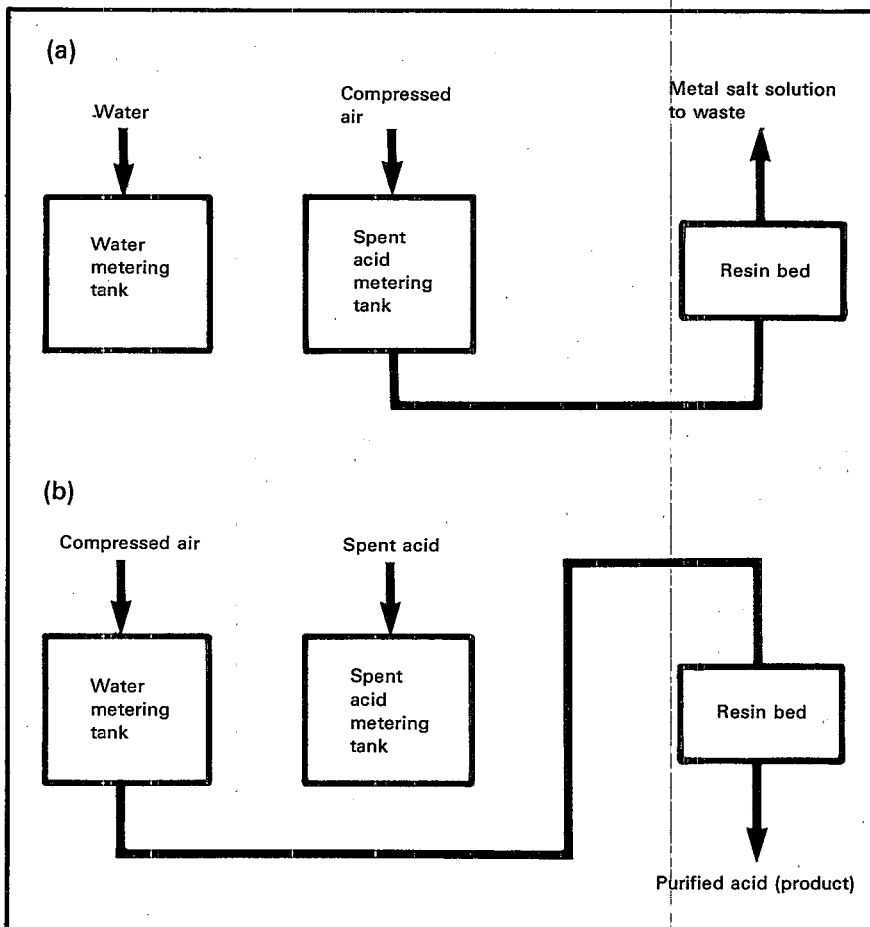


Figure 26.
Acid Recovery System Operation: (a) Upstroke and (b) Downstroke

salt-contaminated acid is metered into the bottom of the resin bed. The free acid is sorbed by the resin and the metal salt byproduct solution flows out the top of the bed. In the regeneration step (downstroke), water elutes the acid from the resin, yielding an acid concentration equal to that of the feed solution and a lower concentration of metal contaminants.

Two applications are seen for this system:

- Purification of strongly acidic process baths
- Recovery of excess acid from cation exchange regenerant solutions

Demonstrated uses of ion exchange acid purification include removing aluminum salts from sulfuric acid anodizing solutions, removing metals from nitric acid rack-stripping solutions, and removing metals from sulfuric and hydrochloric acid pickling solutions. The major area of application is for aluminum anodizing solutions.

Investment in an acid purification system is justified by the savings in purchases of replacement acid and of neutralizing reagents for treating the spent acid. The amount saved depends on the type of acid to be recovered, the volume and concentration of the spent acid discarded yearly, and the cost of treating the spent acid.

Acid purification systems are available in a range of sizes. Size is a function of the volume of acid that can be purified per unit of time; size requirement is determined by the rate at which metal salt accumulates in the acid bath. Table 21 shows the feed, product, and waste stream concentration of a purification system for sulfuric acid

Table 21.

Performance of Acid Recovery Unit for Purifying Sulfuric Acid Pickling Solution

Item	Performance
Water	7.0 gal/h
Feed, at 11 gal/h:	
H ₂ SO ₄	0.94 lb/gal
Iron.....	1.15 lb/gal
Product, at 10.4 gal/h:	
H ₂ SO ₄	0.94 lb/gal
Iron.....	0.74 lb/gal
Purge, at 7.6 gal/h:	
H ₂ SO ₄	0.07 lb/gal
Iron.....	0.65 lb/gal
Iron removed.....	4.9 lb/h
Acid recovered.....	94%

pickling solution. Based on the quantity of iron in the purge stream, the iron salt removal capacity can be determined from volume processing capacity. Once the rate of iron accumulation in the acid solution has been determined, a purification unit with equal salt removal capacity can be selected to control the buildup.

Table 22.

Cost^a and Iron Removal Capacity of Sulfuric Acid Purification Unit

Item	Unit size (ft ³ anion resin)		
	0.40	2.79	14.12
Unit cost (\$) ^b	10,000	20,000	56,000
Acid feed rate (gal/h).....	11	80	400
Iron removal rate (lb/h) ^c	4.9	35.8	179
Savings (\$/h): ^c			
H ₂ SO ₄ , at \$0.05/lb.....	0.31	2.26	11.32
NaOH, at \$0.08/lb ^d	0.41	3.02	15.09

^a1980 dollars.

^bSkid-mounted package unit, including filter and automated control systems.

^cBased on Table 21.

^dFor neutralization.

Acid purification systems are inexpensive and simple to install. Air supply and water are the only utilities needed. Piping requires only feed, product, and waste stream connections. Table 22 gives approximate costs for units of different sizes, the volume of sulfuric pickling acid they can process, and the value of the recovered acid.

In another, well-established application of ion exchange, metal buildup in dilute acid solutions is controlled by passing the solution through a cation exchanger in the hydrogen form. This approach has been used for hydrochloric and sulfuric acid etching solutions and to remove trivalent chromium and ferrous ions from chromic acid solutions.

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Attachment 4
Ocean Outfall Transmission Main Route Options



S SCHOONER CREEK ROAD OCEAN OUTFALL
1" = 600'



VERTICAL STANDPIPE WITH TWO
TIDEFLEX DIFFUSERS (TYP).

~1500 LF PAST SURF BREAK (TYP)

OUTFALL THROUGH SW
51ST ST BEACH ACCESS

PUMP STATION AT
WASTEWATER
TREATMENT PLANT

WASTEWATER PLANT
FACILITIES



SE 51ST ST OCEAN OUTFALL

1" = 600'



SE 54TH DR OCEAN OUTFALL
1" = 600'

Council Communication

17th Street Restroom Project

Meeting Date:	May 14, 2024	Primary Staff Contact:	Daphnee Legarza
Department:	City Council	E-Mail:	DLegarza@lincolncity.org
Secondary Dept:		Secondary Contacts:	
Approval:	Daphnee Legarza	Estimated Time:	30 minutes

Background:

On February 26, 2024, council awarded a Best Value Construction Contract to Creative Contractors for the NE 17th Street Public Restroom Rebuild Project. The contract documents, the basis of the bid, included concept plans. The concept plans were developed by the same architect who designed the Canyon Park Pump Station and Public Restroom Building. We tried to model the look of that building and incorporated the ease of maintenance features.

After further considering the concept plan, including the layout and look, staff met with Creative Contracting and Bearing Architecture to revisit the concept plan and design something more suited for Oceanlake and reconsider layout options. This approach allowed staff to bring these three concepts to the Council and discuss the pros and cons of each.

Attached are the three layout options and building material types that Bearing Architect developed. Creative Contractors have indicated there are no major cost impacts, rather cost reductions, from the original concept plan.

Attachments:

LC Toliet Building - intial pres (PDF)



Standard Colors

ARTIC WHITE	SPECIAL WHITE	SPECIAL BLACK	SPECIAL GRAY FLANNEL	DEEP FROST GRAY	LIGHT FROST GRAY	HEATHER	CUSTOM CLEAR	CUSTOM BUFF	SAGEBRUSH	BUTTERSCOTCH	LIGHT TAMPKO GRAY	DEEP TAMPKO GRAY
SPECIAL BROWN	DEEP RIS BLUE	LIGHT RIS BLUE	DEEP KINGSTON BLUE	LIGHT KINGSTON BLUE	DEEP ASTRA BLUE	LIGHT ASTRA BLUE	DEEP BURMUDA BLUE	LIGHT BURMUDA BLUE	DEEP PEACOCK GREEN	LIGHT PEACOCK GREEN	DEEP HEMLOCK GREEN	LIGHT HEMLOCK GREEN
DEEP LEAF GREEN	LIGHT LEAF GREEN	DEEP OLIVE GREEN	LIGHT OLIVE GREEN	DEEP SPRING GREEN	LIGHT SPRING GREEN	DEEP TROPIC YELLOW	LIGHT TROPIC YELLOW	DEEP CAPRI YELLOW	LIGHT CAPRI YELLOW	DEEP HONEY	LIGHT HONEY	DEEP DESERT YELLOW
LIGHT DESERT YELLOW	DEEP MUSHROOM BROWN	LIGHT MUSHROOM BROWN	DEEP CINNAMON	LIGHT CINNAMON	DEEP PUMPKIN	LIGHT PUMPKIN	DEEP SWEDISH RED	LIGHT SWEDISH RED	DEEP SIERRA RED	LIGHT SIERRA RED		

Vari-Tone Series

BEIGE DE	BEIGE AE	BEIGE CE	BEIGE E	IVORY BE	PEBBLE BE	SANDSTONE BE	TERRACOTTA BE	RUSSETT AD	COPPERSTONE BC	MOCHA BE	WALNUT BC	UMBER AC
GRAY BE	FLINT AC	CHARCOAL A										

Designer Color Series

SEAFOAM GREEN	MIST GREEN	APPLE GREEN	CHAMPAGNE BEIGE	PEARL GRAY	POWDER BLUE	MUTED MAUVE	ROSE PINK	EVERGREEN	GRASS GREEN	MOONLIGHT BLUE	PACIFIC BLUE	PLUM
RED ONE	BRITE ORANGE	SUNSHINE YELLOW	HOT ROSE	CONCORD PURPLE								



Material :
Glazed Block

17th Street Restrooms
Lincoln City



