



City of Seldovia

FINAL Stormwater Management Plan

P.O. Box B

Seldovia, AK 99663

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Photo: Outfall of SEL System (SEL-S-006)



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Table of Contents

1	Introduction	1
2	Stormwater Regulation	2
3	Hydrology.....	3
3.1	Drainage Basins	3
3.2	Precipitation.....	3
3.3	Land Cover and Impervious Area	4
3.4	Soils	5
3.5	Flood Flow Analyses	6
3.6	Water Quality.....	8
4	Existing Infrastructure	10
4.1	Visual Inspections and Inventory	10
4.2	Stormwater Naming Conventions	12
4.3	2023 Community Engagement.....	12
5	Potential Drainage Projects and Prioritization.....	13
5.1	Prioritized Drainage Projects.....	13
5.2	Potential Drainage Projects.....	13
5.3	2024 Community Involvement.....	14
5.4	Prioritization Criteria	14
6	Proposed Drainage Improvement Projects	18
6.1	Kachemak Street Drainage	18
6.2	Main Street Drainage	19
6.3	Frank Raby Drive Drainage.....	21
6.4	City-Wide Sediment Basin Study	21
6.5	Vista Avenue Drainage.....	22
7	General Stormwater Recommendations	27
7.1	Planning, Design, and Construction.....	27
7.2	City Code, Building Requirements, and Land Use Management Plan.....	27
7.2.1	City and Borough of Sitka.....	28
7.2.2	City of Homer.....	28
7.3	Operations and Maintenance	28
7.3.1	Roadways.....	28
7.3.2	Snow Storage and Disposal	29

7.4	Harbor and Boating Activities.....	29
7.5	Community Involvement.....	29
8	Benefits to the Waterbody	30
8.1	Planning, Design, and Construction.....	30
8.2	City Code, Building Requirements, and Land Use Management Plan.....	30
8.3	Operations and Maintenance	30
8.4	Harbor and Boating Activities.....	31
8.5	Community Involvement.....	31
9	Partnership Programs.....	31
10	References.....	34

Figures

Figure 1.	Seldovia Overview Map.....	2
Figure 2.	Conceptual Sketch of Sediment Basin and Overflow Structure Cross Section.....	20

Tables

Table 1.	Land Cover Definitions and Rational Method Runoff Coefficients.....	4
Table 2.	Land Cover Types, Percent Impervious, and Curve Numbers Used	5
Table 3.	Estimated Flood Flows by Outlet.....	7
Table 4.	Existing Stormwater Infrastructure Summary	10
Table 5.	Prioritization Criteria and Scoring	14
Table 6.	Stormwater Infrastructure Prioritization	16
Table 7.	Kachemak Street Drainage Design and Construction Cost Estimate	18
Table 8.	Main Street Drainage Design and Construction Cost Estimate	20
Table 9.	Frank Raby Drive Drainage Design and Construction Cost Estimate.....	21
Table 10.	Estimated Costs for City-Wide Sediment Basin Study.....	22
Table 11.	Vista Avenue Drainage Design and Construction Cost Estimate	23
Table 12.	Stormwater Infrastructure Recommendations.....	24

Appendices

Appendix A – Drainage Maps
Appendix B – Hydrology Calculations
Appendix C – Final Drainage Field Inspection Memo
Appendix D – Stormwater Infrastructure Summary Table
Appendix E – Community Involvement Documents
Appendix F – Drainage Improvement Project (DIP) Maps
Appendix G – Comments and Responses on Draft Stormwater Masterplan

Acronyms and Abbreviations

ACH	Alaska Clean Harbors
ACWA	Alaska Clean Water Actions
ADEC	Alaska Department of Environmental Conservation
AEP	annual exceedance probability
AWC	Anchorage Water Council
C	coefficient
CBS	City and Borough of Sitka
City	City of Seldovia
cfs	cubic feet per second
CMP	corrugated metal pipe(s)
DIP	Drainage Improvement Project
DOT&PF	Alaska Department of Transportation and Public Facilities
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
HDR	HDR Engineering, Inc.
KBNERR	Kachemak Bay National Estuarine Research Reserve
KPB	Kenai Peninsula Borough
MOA	Municipality of Anchorage
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
O&M	operations and maintenance
P	pipe
Q2	2-year flood event
Q5	5-year flood event
Q10	10-year flood event
Q25	25-year flood event
Q50	50-year flood event
Q100	100-year flood event
Q200	200-year flood event
Q500	500-year flood event
ROW	right-of-way
S	structure
SNAP	Scenarios Network for Alaska + Arctic Planning
SS4A	Safe Streets and Roads for All
SVT	Seldovia Village Tribe
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WSDOT	Washington State Department of Transportation

Abbreviated System Names

AIR	Seldovia Airport
ALD	Alder Street
AND	Anderson Way
ARP	Airport Avenue
AST	A Street
AUS	Augustine North Avenue
BLC	Bloch Street
BST	B Street
BYD	City Boat Yard
CST	C Street
DST	D Street
ENG	English Drive
FKR	Frank Raby Drive
FUL	Fulmore Avenue
HBR	Haborview Drive
ILI	Illiamna Street
KAK	Kachemak Street
LIP	Lipke Lane
LSU	Lake Susan
MNS	Main Street
PEN	Peninsula Street
RKY	Rocky Street
SEL	Seldovia Street
SHL	Shoreline Drive
SPG	Spring Street
SPU	Spruce Street
VIS	Vista Avenue
WIL	Willards Way
WIN	Winifred Avenue
WTR	Water Supply Road
YNG	Young Street

1 Introduction

The City of Seldovia (City) received a 2023–2025 Alaska Clean Water Actions (ACWA) grant from the Alaska Department of Environmental Conservation (ADEC) to conduct a drainage study to inventory the City’s existing stormwater infrastructure within city limits (Figure 1), identify nonpoint source pollution impacting local waterbodies, and develop a stormwater management plan. This Stormwater Management Plan will provide guidance for planning and future development aimed to enhance the water quality of stormwater runoff, covering:

- **Section 2 Stormwater Regulation:** Discusses statewide stormwater regulation and best practices resources.
- **Section 3 Hydrology:** Describes Seldovia’s hydrology parameters and estimated flood flows.
- **Section 4 Existing Infrastructure:** Summarizes the City’s existing stormwater infrastructure based on as-builts, local knowledge, and 2023–2024 visual inspections.
- **Section 5 Potential Drainage Projects and Prioritization:** Covers evaluation and prioritization of the existing stormwater systems based on evaluation criteria, community input, and City’s focus.
- **Section 6 Proposed Drainage Improvement Projects:** Details conceptual designs for five prioritized projects.
- **Section 7 General Stormwater Recommendations:** Discusses system-wide recommendations.
- **Section 8 Benefits to the Waterbody:** Summarizes benefit to waterbodies and water quality when implementing stormwater recommendations.
- **Section 9 Partnership Programs:** Describes other programs that could allow for additional collaboration and funding opportunities.

Stormwater is precipitation or snowmelt that has not been evaporated, infiltrated, or otherwise used by the environment. Stormwater runs off the land and can pick up nonpoint source pollutants, such as excess sediment, nutrients, organic matter, bacteria, oil, grease, toxic substances, and heavy metals. Urban development can increase stormwater quantities due to additional impervious areas and can result in erosion, flooding, and increase water temperatures. These pollutants and effects can negatively impact downstream receiving waterbodies.

The ADEC ACWA directive instructs Alaska’s resource agencies (ADEC, Alaska Fish and Game, and the Alaska Department of Natural Resources) to work together to characterize Alaska’s waters in a holistic manner. This cooperative method is used to collect information, direct resources to prevent or correct water quality problems, and identify areas where pollution prevention and watershed planning efforts are encouraged to protect or improve water quality. Every other year, ACWA funds projects through federal funding to further its directive.

ADEC’s Alaska Nonpoint Source Water Pollution Prevention and Restoration Strategy report dated May 2020 listed Seldovia Bay as an at-risk waterbody prioritized to be protected and maintained (ADEC 2020). This ranking is based on high-level analysis including whether the waterbody has a watershed plan and if there are established threats to the watershed. The ranking allows for ADEC funds to be used for projects that support water quality within the watershed.

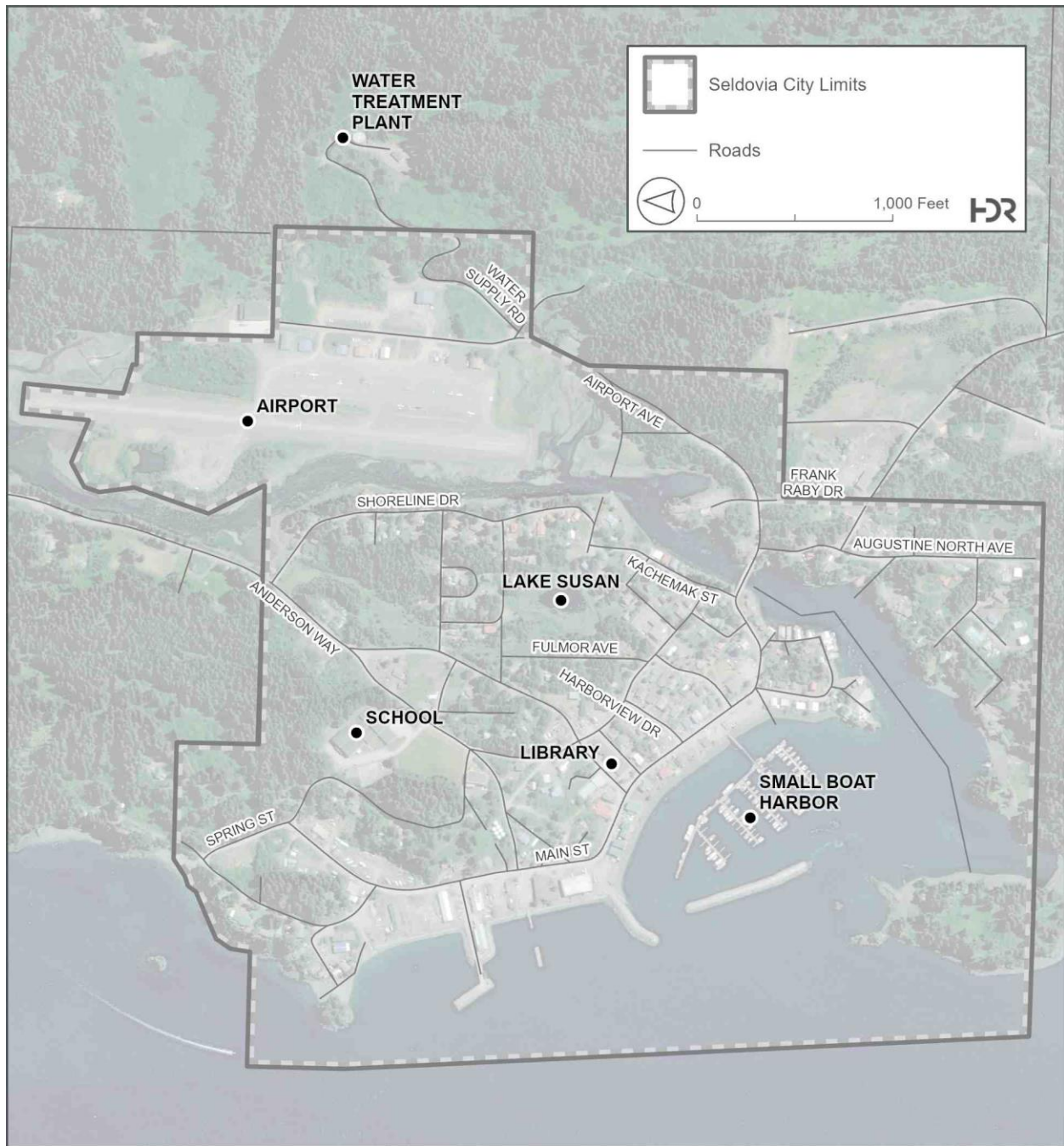


Figure 1. Seldovia Overview Map

Image Source: USACE 2019

2 Stormwater Regulation

Nationally, EPA regulates stormwater under the Clean Water Act through the National Discharge Pollutant Elimination System. In 2008, the State of Alaska gained primacy, and ADEC took over regulating stormwater and implementation of stormwater permits that are commonly for construction activities (Alaska Construction General Permit for projects that disturb over 1 acre), industrial and

commercial activities (Individual stormwater permits), stormwater networks in larger communities (Municipal Separate Storm Sewer Systems), and voluntary coastal zone management. For smaller communities, such as Seldovia, stormwater management is guided by the community's vested interest in its public and environmental health and with the Construction General Permit.

EPA and ADEC provide communities with the following stormwater resources for best practices:

- ADEC Alaska Stormwater Guide, December 2011 (ADEC 2011)
- ADEC Snow Disposal Information and Snow Disposal on Marine Ice and in Open Marine Water (ADEC 2024a)

Stormwater management efforts may also overlap with these programs:

- ADEC Beach Monitoring
- ADEC Contaminated Sites Map (ADEC 2024b)
- ADEC Integrated Water Quality Monitoring and Assessment
- U.S. Army Corps of Engineers (USACE) Section 10/404 permits

Proactive stormwater management aims to improve water quality and reduce the volume of stormwater and pollutant load within the community. Generally, best practices include minimizing the pollutant source before it can be transported by stormwater runoff, and to capture, infiltrate, and treat runoff before it reaches surface waters.

3 Hydrology

Seldovia experiences a temperate oceanic climate with mild winters and cool summers. Environmental Systems Research Institute, Inc., ArcGIS Pro (version 3.3.2) was used to visualize publicly available, georeferenced datasets. The 2019 USACE National Coastal Mapping Program Phase One Natural Color 8 Bit Imagery: Seldovia, AK, was used for imagery; 2019 USACE National Coastal Mapping Program Topobathy Lidar Digital Elevation Model: Alaska was used for elevation data; and Kenai Peninsula Borough (KPB) GeoHub data was used for anadromous waters, city limits, facilities, redacted parcels, and roads layers (USACE 2019; KPB 2023).

3.1 Drainage Basins

The ArcGIS Pro Hydrology Toolbox was used to develop flow direction and flow accumulation rasters using the 2019 USACE Topobathy dataset (USACE 2019). Drainage basins were delineated based on the existing stormwater systems located within city limits using visual determination. Project drainage basins range from 0.07 to 46 acres, with specific areas provided in Section 3.5. Drainage basins are also shown on maps in Appendix A.

3.2 Precipitation

Seldovia received an annual average of 40 inches of precipitation from 2000 to 2024 (National Oceanic and Atmospheric Administration [NOAA] 2024). Generally, Seldovia is the driest in June with an average of 1.26 inches of precipitation, and the wettest in September with an average of 5 inches (NOAA 2024). Partial duration precipitation data was obtained from NOAA Atlas historic 14-point precipitation frequency estimates (NOAA 2012).

Climate non-stationarity was considered using the University of Alaska Fairbanks (UAF) Scenarios Network for Alaska + Arctic Planning's (SNAP) precipitation projections for Alaska infrastructure dataset (UAF 2024a). Within SNAP, the Arctic Environmental and Engineering Data and Design Support System (UAF 2024b) uses downscaled climate models to provide precipitation projections for a range of annual exceedance probabilities (AEP), durations, and eras. The National Center for Atmospheric Results CCSM4 and GFDL CM3 model results for 2020–2049 were compared to their respective results for 2050–2079 (based on a 50-year infrastructure service life). The calculated change for some of the AEPs predicted a decrease in precipitation over the service life. Due to this, the application of these models would not be representative of the most conservative approach, and thus their results were not incorporated into the flood flow estimates.

3.3 Land Cover and Impervious Area

Land cover and impervious areas were determined using the 2019 USACE imagery, KPB parcels, and 2023 visual inspection notes (described in Section 4 Existing Infrastructure). To determine land cover and Rational Method runoff coefficients, the 2011 ADEC Storm Water Guide (ADEC 2011) references the Washington State Department of Transportation (WSDOT) Hydraulics Manual (WSDOT 2005). However, the updated 2024 WSDOT Hydraulics Manual (WSDOT 2024) was used to categorize land cover areas as the 2005 WSDOT Hydraulics Manual and 2011 ADEC Storm Water Guide have limited land cover categories that apply to Seldovia.

Using the 2024 WSDOT Hydraulics Manual, land use was generalized into eleven categories from which runoff coefficients were determined and defined in Table 1. The runoff coefficients were used to determine the flood flow estimates (refer to Section 3.5) and are dependent on the basin's average slope. "Hilly slope" relates to slopes greater than 10-percent and "rolling slope" relates to 2- to 10-percent slopes. The manual provides base runoff coefficients for the 10 percent AEP (Q10) event and applies percent increases to the runoff coefficients for larger, less frequent flood flow events. Rational Method runoff coefficients were determined for the 2 percent AEP (Q50) event applying a 20 percent increase to the base runoff coefficients (WSDOT 2024). Per the guidance, the highest runoff coefficient applied was 0.95 (WSDOT 2024).

Table 1. Land Cover Definitions and Rational Method Runoff Coefficients

Land Cover Type	Rational Method Runoff Coefficient (C)	Definition
City Business Area	Hilly and Rolling Slope: 0.95 ^a	Business centers within the city limits, mostly concentrated in the main downtown area.
Commercial, Industrial	Hilly and Rolling Slope: 0.95 ^a	Areas with larger swathes of developed land (mostly equipment yards and storage areas).
Dirt/Gravel Roads	Hilly Slope: 0.72 Rolling Slope: 0.66	In addition to dirt and gravel roads, this land cover type was used to delineate the airstrip and surrounding gravel.
Forest	Hilly Slope: 0.24 Rolling Slope: 0.18	Areas where tall, coniferous trees were the dominant vegetation cover.
Grassy Shoulder	Hilly and Rolling Slope: 0.3	Used to delineate swales and other vegetated areas within developed areas, most prominently in the swales and vegetated shoulders of the airport.
Impervious	Hilly and Rolling Slope: 0.95 ^a	All pavement and roofs, when applicable.
Industrial, Heavy	Hilly Slope: 0.95 ^a Rolling Slope: 0.80	Landfills and large areas of graded dirt.
Lawn	Hilly Slope: 0.24	Open stands of maintained grass, mostly around the school.

Land Cover Type	Rational Method Runoff Coefficient (C)	Definition
	Rolling Slope: 0.18	
Single-Family Residential	Hilly Slope: 0.60 Rolling Slope: 0.48	Residential parcels with minimal backyard space closer to the downtown area.
Suburban Residential	Hilly Slope: 0.48 Rolling Slope: 0.42	Residential parcels outside of the main downtown area with larger backyard areas and generally more green space on the property.
Undeveloped	Hilly and Rolling Slope: 0.36	Areas where no development has occurred and are not dominated by tree cover; used as a general land cover delineation to include wetlands, brush, etc.

^a These values, with the 20-percent increase for using the 2% AEP/Q50 design storm, exceeded the 0.95 maximum threshold, leading to these being set to 0.95 per manual instructions (WSDOT 2024).

Each land use has an associated percent impervious value that estimates the area that prevents or reduces the amount of stormwater from soaking into the ground. In urban environments, impervious areas are commonly streets, parking lots, and rooftops. Impervious area values can be used in hydrology calculations to estimate flood flows, highlight where environmental impacts and mitigation measures may need to occur, and gauge the overall amount of urbanization. Percent impervious values and curve numbers assigned to each land cover type can be found below in Table 2. These values were adapted from values provided in the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service's (NRCS) Urban Hydrology for Small Watersheds report (USDA NRCS 1986).

Table 2. Land Cover Types, Percent Impervious, and Curve Numbers Used

Land Cover Type	Percent Impervious (%)	Curve Number
City Business Area	85	94
Commercial, Industrial	85	94
Dirt/Gravel Roads	40	88 ^a
Forest	0	70
Grassy Shoulder	0	71 ^b
Impervious	100	98
Industrial, Heavy	72	91
Lawn	0	86 ^c
Single-Family Residential	38	83
Suburban Residential	25	80
Undeveloped	0	70 ^d

Note: Based on values from Urban Hydrology for Small Watersheds (USDA NRCS 1986)

^a Average of "Dirt" and "Gravel" curve numbers.

^b Based on "Meadow" curve number.

^c Based on "Pasture" curve number.

^d Based on "Brush (Fair Conditions)" curve number.

3.4 Soils

The USDA NRCS Web Soil Survey was used to determine general soil characteristics around Seldovia. Typical soils within the vicinity of the City consist of loams varying from silt to gravel loams, commonly as soil types Kasitsna-Nuka-Tutka complex and the Kasitsna-Tutka (rolling to steep, hilly to very steep) complex. The Kasitsna-Nuka-Tutka complex is found in the populated areas south of Seldovia Slough, while the Kasitsna-Tutka (rolling to steep) complex is found around the rest of the

City mixed in between urban development. The Kasitsna-Tutka complex (hilly to very steep) is found everywhere northeast of the Iliamna Street and Inlet Street intersection. The Kasitsna soil unit consist of upper layers (3–20 inches below ground) of silt loams grading down to lower layers of coarser sandy loams (20–33 inches below ground) and gravelly loams (33–60 inches below ground). The Tutka unit has a compositional profile similar to that of the Kasitsna, but the silt loam ranges from 7 to 13 inches below ground, with gravelly loam 13 to 21 inches below ground and bedrock at 21 inches below ground. The Nuka unit of the Kasitsna-Nuka-Tutka complex is a unit consisting of peat and mucky peat for the top 47 inches and grading down to gravelly loam down to depths of 60 inches (USDA NRCS 2024).

Hydrologic groups for the soils in the area range from Group B, which indicates a moderate ability to infiltrate runoff, to Group D, which indicates a high runoff potential and low infiltration ability (USDA NRCS 2024). The Kasitsna-Nuka-Tutka complex is rated as a Group D soil group, likely due to the present of the Nuka peat, while the Kasitsna-Tutka complex is rated as a Group B soil group (USDA NRCS 2024).

Groundwater has been commonly found approximately 6.56 feet below the surface (USDA NRCS 2024). For Lake Susan, groundwater has been found approximately 0.26 foot below the surface (USDA NRCS 2024).

In Southcentral Alaska, ADEC estimates the frost line at 4 to 6 feet below the surface (ADEC 2011).

Bedrock found around Seldovia is present in various locations around the City and includes lithologies containing basalt and chert (Bradley et al. 1999). Geotechnical investigations are recommended for site-specific information.

3.5 Flood Flow Analyses

Flood flow estimates were calculated using the Rational Method. The Rational Method is valid for drainage basins less than 200 acres in size and assumes that an entire, small watershed is contributing runoff when rainfall is distributed uniformly over the basin to determine flood flow estimates. This method uses basin area, a weighted runoff coefficient based on land cover type, flow length, elevation change, slope, time of concentration, and precipitation data to determine flood flow estimates (Municipality of Anchorage [MOA] 2017; WSDOT 2024). Seldovia has characteristically steep drainage basins with a City-wide average slope of 17 percent. The Kirpich equation was chosen to calculate the time of concentration as it is intended for steep, high-runoff conditions, representative of the City's basins (MOA 2017). Time of concentration is the time it takes for runoff to travel from the hydraulically most distant point of the watershed to the point of interest in the watershed (collection point). It is calculated by summing all the travel times for consecutive components of the drainage flow path – split up by landcover and type of flow. This concept assumes that rainfall is applied at a constant rate over a drainage basin to produce a constant peak rate of runoff. The 2019 USACE imagery and 2019 USACE Topobathy dataset were used to estimate the method's area, flow length, elevation-related inputs. The 2024 WSDOT Hydraulics Manual (WSDOT 2024) was used to determine runoff coefficients based on the 2011 ADEC Stormwater Guide (ADEC 2011) reference (the 2005 WSDOT Hydraulics Manual) and that they could be applied to less-frequent AEP events (4 percent AEP and less frequent). The runoff coefficients for the 2 percent AEP (Q50) event were conservatively applied to all the events analyzed to aid in simplicity. NOAA Atlas 14-point precipitation frequency values were used as the

precipitation intensity inputs (NOAA 2012). The flood flow estimates are summarized in Table 3 and their associated calculations are provided in Appendix B.

Table 3. Estimated Flood Flows by Outlet

Rational Method Flow Estimates (cfs)										
Stormwater System Basin	Location	Basin Size (acres)	% AEP/Recurrence-Interval Flood (cfs)							
			50%	20%	10%	4%	2%	1%	0.50%	0.20%
			Q2	Q5	Q10	Q25	Q50	Q100	Q200	Q500
ARP	Airport Avenue	13.6	6.5	8.3	9.7	11.7	13.3	14.9	17.0	19.7
AIR NE	Airport NE	10.5	5.0	6.3	7.4	9.0	10.2	11.4	13.0	15.0
AIR NW	Airport NW	6.4	3.9	5.0	5.9	7.1	8.0	8.9	10.2	11.8
AIR SE	Airport SE	37.9	11.7	14.8	17.5	21.0	23.9	26.6	30.3	35.3
AIR SW	Airport SW	2.6	1.8	2.3	2.8	3.3	3.8	4.2	4.8	5.6
BST	B Street	1.6	0.8	1.0	1.2	1.4	1.6	1.8	2.1	2.4
CST, AUG	C Street	43.2	16.3	20.6	24.4	29.2	33.2	37.1	42.3	49.1
BYD	City Boat Yard	5.9	4.4	5.5	6.5	7.9	8.9	9.9	11.4	13.2
DST, AUG	D Street	2.9	1.9	2.4	2.8	3.4	3.9	4.3	4.9	5.7
ENG	English Drive	4.9	3.0	3.7	4.4	5.3	6.0	6.7	7.7	8.9
FKR	Frank Raby Drive East	5.9	6.1	7.8	9.1	11.0	12.5	14.0	15.9	18.5
FKR, RKY	Frank Raby Drive West	5.8	2.6	3.3	3.9	4.6	5.3	5.9	6.7	7.8
FUL	Fulmore Avenue	5.5	4.2	5.4	6.3	7.6	8.7	9.6	11.0	12.8
HBR	Haborview Drive	1.5	1.1	1.5	1.7	2.1	2.3	2.6	3.0	3.5
ILI	Illiamna Street	2.04	1.6	2.0	2.3	2.8	3.2	3.6	4.1	4.7
KAK	Kachemak Street	1.1	0.9	1.1	1.3	1.6	1.8	2.0	2.3	2.6
LSU, BLC	Lake Street	14.6	6.5	8.2	9.7	11.6	13.2	14.7	16.8	19.5
MNS	Main Street	2.6	2.3	2.9	3.4	4.1	4.6	5.2	5.9	6.8
PEN	Peninsula Street	1.7	1.7	2.1	2.5	3.0	3.4	3.8	4.3	5.0
ARP E	Seldovia Bridge E	0.9	0.6	0.7	0.8	1.0	1.1	1.3	1.5	1.7
ARP W	Seldovia Bridge W	0.07	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
SEL, ALD, LIP	Seldovia Street	13.03	8.7	11.1	13.1	15.7	17.9	19.9	22.7	26.4
SHL E	Shoreline Dr. S	1.8	1.2	1.5	1.8	2.2	2.5	2.8	3.2	3.7
SHL N	Shoreline Drive N	42.4	15.0	19.0	22.5	27.0	30.7	34.3	39.1	45.4
SPG, VIS	Spring Street	10.5	6.0	7.6	8.9	10.8	12.2	13.6	15.6	18.1
SPU	Spruce Street	4.33	4.5	5.7	6.8	8.2	9.3	10.3	11.8	13.7

Notes: cfs = cubic feet per second.

Flood flow estimates are defined by a recurrence interval or as an AEP. A recurrence interval (or return period) is described as the average number of years between floods of a certain size and is based on the probability that the given event will be equaled or exceeded in any given year. An AEP is the percent chance of occurrence in any given year and is always provided as a fraction of 1. For

example, a 2-year recurrence interval flood is a 0.5 AEP flood (1/2) or has a 50 percent chance of occurring in any given year. A 50-year recurrence interval flood is a 0.02 AEP flood (1/50) or has a 2 percent chance of occurring in any given year. AEP is the preferred terminology, as it reminds the user that a flood event is not related to a specific time interval but instead as a chance of occurring.

3.6 Water Quality

Limited water quality monitoring is available for Seldovia Bay and contributing streams. The Seldovia Village Tribe (SVT) has obtained water quality data in the past (2013 and prior) that is summarized on their Node/Spatial Viewer website (SVT 2017). More recently in 2023, stormwater water quality impacts were assessed by City, community, and stakeholder input as well as by visual inspection. No specific areas were identified with major stormwater-related water quality concerns, and no common sources of stormwater pollutants were noted. However, water quality generally applies to boating activities, construction, land cover and impervious area, road maintenance, sediment, and vehicle maintenance and washing.

With improper response, boating-related spills, hazardous material, and debris can contribute to stormwater pollution. **Boating activities** within the City's harbor and boat yards include mooring, cleaning, and maintenance. The Seldovia Boat Harbor does not have fuel or pump out facilities (closest facilities are in Homer). The Harbormaster's office has spill response materials (spill kit and absorbent pads) available and the City has an agreement with the Seldovia Oil Response Team to provide on-call spill response. At the Harbor, there is signage informing the public about the Homer pump out location and associated hours and about reporting spills. Community input included one comment about seeing sheens in the harbor that were thought to be due to stormwater pollution, leaking residential or industrial fuel tanks, or draining of bilge discharge (the water that collects in the lowest part of a vessel and is commonly susceptible to contaminants). In speaking with the Harbormaster, spills tend to be rare and the source is often not originally from the harbor (residential or industrial fuel tank leaks that flow to the harbor). During the 2023 visual inspection, no apparent water quality concerns from the harbor or City boat yards were identified.

Construction-related activities that include ground disturbing work can impact stormwater quality, as stormwater flows over the construction site it can pick up pollutants such as sediment, debris, and chemicals and cause erosion. The Alaska Construction General Permit is commonly required for projects that disturb over 1 acre and aims to minimize erosion and reduce or eliminate the discharge of pollutants. Best Management Practices can be encouraged on smaller projects or maintenance activities to minimize impacts further. During the 2023 visual inspection, sediment track-out from construction sites was discussed as a potential impact to water quality.

Land cover and impervious area can also impact stormwater quality, especially due to increased development over time. During the 2023 visual inspection, some locations with exposed bedrock were noted, indicating additional investigation may be required to implement stormwater improvements if there is a potential to encounter bedrock. Undeveloped lots were also noted, indicating Seldovia may still see development in the future that changes stormwater runoff flows.

Road maintenance activities include year-round operations and maintenance (O&M) by the City and the Alaska Department of Transportation and Public Facilities (DOT&PF). Outside of City limits, DOT&PF applies calcium chloride to the roads as a dust suppressant. Within City limits, DOT&PF

rarely uses calcium chloride on the roads per the request of the City and community. Infrequently, calcium chloride or salt is used to melt frozen inlets.

The City, DOT&PF, and SVT all manage snow removal and storage activities throughout the winter and shoulder seasons. Snow removal occurs during and directly after snowfall events, before gravel or roadway chemicals might be introduced. O&M staff attempt to store snow close to its source to reduce hauling time and cost; however, many of the roads within the community are challenging to plow and store snow along due to their steep and/or narrow characteristics. Commonly, snow is piled in locations with available space and pushed onto coastal rock along Seldovia Slough and Seldovia Bay, which is allowed by ADEC (see Section 7.3). Other winter road maintenance includes application of gravel (1 inch minus material) to the roads to increase traction, which DOT&PF does through an agreement with the City. When temperatures warm up, snowmelt enters adjacent drainage infrastructure or waterbodies and can transport and leave behind gravel and sediment.

During the 2023 and 2024 visual inspections, **sediment** accumulation in curblines, catch basins, storm manholes, and within culverts was commonly observed across the whole drainage system. Accumulated sediment ranged from fine to gravel-sized particles. Sources of sediment are thought to be from the track-out sediment from gravel roads and lots, sediment placed to increase traction in the winter, and sediment suspended or eroded by surface flows. Sediment transported by stormwater flow can increase turbidity and deposition in the receiving waterbody. They can also carry pollutants such as nutrients, heavy metals, organic chemicals, bacteria and other pathogens that can contribute to potential water quality impacts such as increased temperature and decreased dissolved oxygen. Harbor staff indicated sediment heavy stormwater has been seen coming out of outfalls around the Seldovia Boat Harbor due to the high stormwater flows and velocities. Street sweeping is conducted annually in the spring to remove some of the sediment load.

Vehicle maintenance and washing can release pollutants such as hydrocarbons and heavy metals if not conducted properly. Maintenance activities such as cleaning auto parts, changing vehicle fluids, and repairing and replacing equipment generate waste that can spill or be improperly disposed of. Outdoor car washing can introduce detergents, nutrients, metals, and hydrocarbons to the stormwater system. During the 2023 visual inspection, no apparent water quality concerns from vehicle maintenance and washing were identified.

The City conducts an annual spring cleanup **public outreach** event. After snowmelt in spring, the City provides trash bags and encourages the community to clean up the city over a day or weeklong event. Afterward, the City picks up and disposes of the collected trash. The Seldovia Rocky Ridge Landfill accepts used oil and an annual hazardous waste disposal is held with the hazardous waste barged to Homer.

Disturbance of contaminated sites can impact water quality and therefore should be investigated and mitigated during project planning. There are two active ADEC **Contaminated Sites** in Seldovia to be aware of (ADEC 2024b). Brief descriptions of the active sites are provided below:

1. The “Hopkins Construction Company” contaminated site combines two locations: 256 Lipke Lane and 280 Alder Street. In 1994, petroleum-contaminated groundwater was encountered on 256 Lipke Lane. Contamination is thought to be from a Housing and Urban Development contractor from 1974. 280 Alder Street is a suspected release site.

2. The “Seldovia Tank Farm” contaminated site is located at 271 English Drive. The site was added in 2009 when utility excavation encountered diesel contamination immediately downgradient of the Seldovia Tank Farm. Diesel range organics, gasoline range organics, and benzene were detected (ADEC 2024b).

The ADEC Contaminated Sites website (ADEC 2024b) should be consulted for updates on active sites. Impacts from an active contaminated site should be mitigated before ground disturbing projects occur.

4 Existing Infrastructure

After the 1964 Earthquake, the 1969 Urban Renewal project and various other projects between 1983 and 1993 implemented significant roadway and drainage improvements around Seldovia. Input from the City, community, and stakeholders in 2023 and 2024 was also used to learn more about the existing stormwater infrastructure and identify areas of frequent concern.

4.1 Visual Inspections and Inventory

Drainage infrastructure was initially identified using as-builts provided by the City (City Various) and the 2019 USACE imagery, and then field-verified or corrected based on visual inspections. HDR Engineering, Inc. (HDR) conducted two field inspections (September 25–29, 2023, and August 26–29, 2024) to visually inspect the existing stormwater system. The purpose of these inspections was to inspect, map, and investigate concerns with the existing drainage infrastructure. The City was divided into 28 drainage systems, grouped based on the roadways they drain. Appendix C – Final Drainage Field Inspection Memo provides a summary of the 2023 visual field inspection and detailed information about each existing stormwater system (HDR 2024). Table 4 summarizes basic information about the existing stormwater infrastructure. Appendix D provides a detailed summary table of the drainage infrastructure.

The majority of the existing drainage infrastructure was inventoried in 2023. However, a few updates were located and recorded based on the 2024 visual inspection. The existing systems layouts are provided in Appendix A – Drainage Maps.

Table 4. Existing Stormwater Infrastructure Summary

Stormwater System	Location	Year Constructed/ Substantially Modified	Number of Structures in System
AIR	Seldovia Airport	1985	2 Pipes 12 Culverts 1 Manhole
ALD	Alder Street	1969	3 Pipes 1 Manhole 2 Catch Basin
AND	Anderson Way	1984	1 Pipe 2 Culverts 1 Catch Basin

Stormwater System	Location	Year Constructed/ Substantially Modified	Number of Structures in System
ARP	Airport Avenue	1979	6 Pipes 1 Culvert 1 Manhole 4 Catch Basins 3 Outfalls
AST	A Street	1983	2 Culverts
AUG	Augustine North Avenue	1983	2 Culverts
-	Bay Street	1965	N/A
BLC	Bloch Street	1991	1 Culvert
BST	B Street	1983	1 Culvert
BYD	City Boat Yard, Main Street	1984	2 Pipes 2 Catch Basins 1 Outlet
CST	C Street	1982	5 Culverts 1 Outlet
DST	D Street	1982	2 Pipes 1 Manhole 1 Outfall
ENG	English Drive	1982	6 Pipes 1 Culvert 1 Manhole 4 Catch Basins 1 Outfall
FKR	Frank Raby Drive	1991	6 Culverts
FUL	Fulmor Avenue, Alder Street, Main Street	1976.5	7 Pipes 6 Catch Basins 1 Manhole 1 Outlet
HBR	Harborview Drive	1984	2 Pipes 2 Catch Basins 1 Outlet
ILI	Iliamna Street	1983	2 Pipes 1 Catch Basin 1 Manhole 1 Outlet
KAK	Kachemak Street	1993	2 Pipes 1 Catch Basin 1 Manhole 1 Outlet
LIP	Lipke Lane	1984	2 Pipes 2 Catch Basins
LSU	Lake Susan, Lake Street, Kachemak Street	1992	3 Pipes 2 Manholes 1 Outlet

Stormwater System	Location	Year Constructed/ Substantially Modified	Number of Structures in System
MNS	Main Street	1983	3 Pipes 3 Catch Basins 1 Outlet
PEN	Peninsula Street	1983	2 Pipes 2 Catch Basins 1 Outlet
RKY	Rocky Street	1991	1 Culvert
SEL	Seldovia Street, Main Street	1984	5 Pipes 4 Catch Basins 1 Manhole 1 Outlet
SHL	Shoreline Drive	1983	2 Culverts
SPG	Spring Street	1991	1 Culvert
SPU	Spruce Street	1991	1 Culvert
VIS	Vista Avenue, Main Street	1983	1 Pipe 2 Culverts
WIL	Willards Way	1983	1 Culvert
WIN	Winifred Avenue, Alder Street, Anderson Way	1983	3 Pipes 2 Culverts 1 Catch Basin
WTR	Water Supply Road	2017	N/A
YNG	Young Street	1987	1 Culvert

Notes: N/A = not applicable.

4.2 Stormwater Naming Conventions

Naming conventions consist of three letters, followed by one letter, and then followed by three numbers, such as: XXX-P-### or XXX-S-###.

- The first three letters correspond to the system's abbreviated name;
- The following single letter is either a P for pipe or culvert, or an S for structure; and
- The three numbers generally correspond to the sequential number in the system.

Pipes connect to drainage systems, whereas culverts are open-ended pipes that provide cross drainage; both are indicated by P. Structures (S) indicate catch basins, manholes, and outlets. In this context, an outlet refers to the open end of a pipe at the terminus of a drainage system. Drainage infrastructure with a name that ends with an asterisk (*) indicates that a portion (or all) of the feature was not located during field inspections. In these cases, available record drawings were used to supplement field inspections.

4.3 2023 Community Engagement

In 2023, a 10-question online drainage and stormwater survey was open to the community from August 21 through September 29, 2023, to gain insight on local stormwater and drainage concerns.

The community was informed of the survey through a postcard mailer sent to 225 addresses, social media posts by the City, physical postings around town, and word of mouth. In addition to the survey, a project email and phone number was provided to collect input and answer questions. A 1-hour Drainage Working Session, hosted by the City on September 25, 2023, was attended by the City Council and open to the public to allow HDR to discuss this project's objectives, schedule, and anticipated outcomes. The 2023 community outreach received responses from 13 community members that aggregated 42 points of interest.

During this same engagement period, HDR held meetings with the City Public Works Department, DOT&PF O&M, and SVT. These meetings were to inform those stakeholders about the project and gain their insight on local stormwater and drainage concerns. Major topics discussed with City Public Works and DOT&PF included areas of responsibility, agreements, O&M activities, areas of frequent drainage concern, snow removal and storage, and planned infrastructure projects. Major topics discussed with SVT were areas of frequent drainage concern, and snow removal and storage. The topics from these discussions were incorporated into visual inspection notes and recorded stakeholder input.

The 2023 and 2024 (see Section 5) community and stakeholder questions, responses, and notes are provided in Appendix E.

5 Potential Drainage Projects and Prioritization

Based on as-builts and confirmed by visual inspection, some of the existing stormwater systems are near or past their useful life. From the collected stormwater information in 2023, recommendations were brought forward and developed into a list of potential drainage projects. During 2024, City, community, and stakeholder input was requested to determine the importance of the potential drainage projects. Incorporating all the information collected in 2023 and 2024, prioritization criteria were developed to build a list of important drainage improvements for the community.

5.1 Prioritized Drainage Projects

From the 2023 collected data, community input, and initial stormwater recommendations, a list of 12 potential drainage projects emerged. The City prioritized three of these projects:

- Kachemak Street Drainage
- Main Street Drainage
- Vista Avenue Drainage

5.2 Potential Drainage Projects

The remaining nine potential drainage projects included:

- Anderson Way Drainage
- Bay Street Drainage
- City-wide Sediment Basin Study
- Frank Raby Drive Drainage
- Lake Susan
- Shoreline Drive Drainage

- Slough Bridge Drainage
- Water Supply Road Drainage
- Winifred Avenue Drainage

Descriptions of the potential drainage projects are provided in Appendix E.

5.3 2024 Community Involvement

In 2024, a second online drainage and stormwater survey was open to the community from August 1 through September 6, 2024, to obtain feedback on the perceived importance of the nine potential drainage projects. Community members were asked to rank the projects to inform the City of how to prioritize the remaining projects. Similar to the 2023 survey, the community was informed of the survey through a postcard mailer, City social media posts, physical postings around town, and word of mouth. The project email and phone number were still available. A second, 1-hour Drainage Working Session, hosted by the City on August 26, 2024, was attended by the City Council and open to the public to allow HDR to summarize 2023 project efforts and discuss potential drainage projects. The 2024 community outreach received responses from 13 community members that provided insight on which potential projects held greater importance to the community. The three community-ranked highest importance projects were:

1. City-wide Sediment Basin Study
2. Shoreline Drive Drainage
3. Anderson Way Drainage

The 2024 community and stakeholder questions and responses are provided in Appendix E.

5.4 Prioritization Criteria

Prioritization criteria were developed to infer important and impactful drainage improvements for the community. The prioritization has four categories: Average Age of Infrastructure, Visual Inspections Rating, Annual Cost Impact, and Community Impact. Each category has scores that are associated with a weight of 0–40. Each drainage system was assessed based on the information collected in 2023 and 2024. By drainage system, the points across the categories are combined to create a total score and prioritization. More points correspond to a higher importance of making stormwater improvements to that system. The prioritization criteria and scores of the existing systems are provided in Table 5. Appendix D provides a detailed stormwater infrastructure summary table.

Table 5. Prioritization Criteria and Scoring

Average Age of Infrastructure	Score	Visual Inspections Rating	Score	Annual Cost Impact	Score	Community Impact	Score
0–19 years	0	Functioning	0	Low	0	<u>Isolated</u> 0–2 owners and/or occasional/ infrequent failure of system	0
20–49 years	10	Needs Replacement - Low Priority	20	Medium	10	<u>Neighborhood</u> 4+ owners and/or annual failure of system	10

50+ years	20	Needs Replacement - High Priority	40	High	20	Community-wide Vital infrastructure and/or frequent (monthly or more often) failure of system	20
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The “Average Age of Infrastructure” criteria were based on the average age of stormwater infrastructure in Seldovia and the average service life of a corrugated metal pipe (CMP). Generally, CMPs have an estimated service life of 50 to 75 years, which can vary based on material, coating, and environmental conditions. A shorter service life is common in coastal environments. The average ages of stormwater systems were estimated based the as-built(s) in which the infrastructure first appeared closest to its current configuration (City Various).

The “Visual Inspections Rating” criteria were based on the September 2023 and August 2024 visual inspections conducted by HDR. Parameters including existing infrastructure condition, drainage effectiveness, and impacts on the greater drainage system were taken into consideration.

The “Annual Cost Impact” criteria were based on the estimated cost to maintain the existing drainage infrastructure. The estimations were informed by the 2023 and 2024 drainage O&M activities and emergency repairs through qualitative and quantitative costs provided by the City.

The “Community Impact” criteria were based on the number of property owners affected and the frequency of the impact occurring. Responses from the community surveys, stakeholder input, and City information were taken into consideration to determine the ranking of each existing drainage system.

The applied prioritization criteria and prioritization score for each drainage system are provided in Appendix D – Stormwater Infrastructure Summary Table.

Table 6. Stormwater Infrastructure Prioritization

Stormwater System	Location	Average Age of Infrastructure		Visual Inspections Rating		Annual Cost Impact		Community Impact		Prioritization Total Score
		Age	Score	Rating	Score	Impact	Score	Impact	Score	
KAK	Kachemak Street	31	10	Needs Replacement - High Priority	40	High	20	Neighborhood	10	80
MNS	Main Street	41	10	Needs Replacement - High Priority	40	Medium	10	Community-Wide	20	80
FKR	Frank Raby Drive	33	10	Needs Replacement - High Priority	40	Medium	10	Neighborhood	10	70
PEN	Peninsula Street	41	10	Needs Replacement - High Priority	40	Low	0	Community-Wide	20	70
RKY	Rocky Street	33	10	Needs Replacement - High Priority	40	Medium	10	Neighborhood	10	70
-	Citywide (Sediment Basin)	39	10	Needs Replacement - Low Priority	20	Medium	10	Community-Wide	20	60
ARP	Airport Avenue	45	10	Needs Replacement - Low Priority	20	Medium	10	Community-Wide	20	60
VIS	Vista Avenue, Main Street	41	10	Needs Replacement - Low Priority	20	High	20	Neighborhood	10	60
WTR	Water Supply Road	7	0	Needs Replacement - Low Priority	20	High	20	Community-Wide	20	60
ALD	Alder Street	55	20	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	50
BAY	Bay Street	59	20	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	50
BYD	City Boat Yard, Main Street	40	10	Needs Replacement - Low Priority	20	Low	0	Community-Wide	20	50
SEL	Seldovia Street, Main Street	40	10	Needs Replacement - Low Priority	20	Low	0	Community-Wide	20	50
WIN	Winifred Avenue, Alder Street, Anderson Way	41	10	Needs Replacement - Low Priority	20	Low	0	Community-Wide	20	50
AND	Anderson Way	40	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
CST	C Street	42	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
ENG	English Drive	42	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
FUL	Fulmor Avenue, Alder Street, Main Street	47.5	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40

Stormwater System	Location	Average Age of Infrastructure		Visual Inspections Rating		Annual Cost Impact		Community Impact		Prioritization Total Score
		Age	Score	Rating	Score	Impact	Score	Impact	Score	
SHL	Shoreline Drive	41	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
AIR	Seldovia Airport	39	10	Functioning	0	Low	0	Community-Wide	20	30
AUG	Augustine North Avenue	41	10	Functioning	0	Medium	10	Neighborhood	10	30
BLC	Bloch Street	33	10	Functioning	0	Low	0	Neighborhood	10	20
DST	D Street	42	10	Functioning	0	Low	0	Neighborhood	10	20
HBR	Harborview Drive	40	10	Functioning	0	Low	0	Neighborhood	10	20
ILI	Iliamna Street	41	10	Functioning	0	Low	0	Neighborhood	10	20
LIP	Lipke Lane	40	10	Functioning	0	Low	0	Neighborhood	10	20
YNG	Young Street	37	10	Functioning	0	Low	0	Neighborhood	10	20
AST	A Street	41	10	Functioning	0	Low	0	Isolated	0	10
BST	B Street	41	10	Functioning	0	Low	0	Isolated	0	10
LSU	Lake Susan, Lake Street, Kachemak Street	32	10	Functioning	0	Low	0	Isolated	0	10
SPG	Spring Street	33	10	Functioning	0	Low	0	Isolated	0	10
SPU	Spruce Street	33	10	Functioning	0	Low	0	Isolated	0	10
WIL	Willards Way	41	10	Functioning	0	Low	0	Isolated	0	10

Notes: Sorted by Prioritization Score. Visual Inspections Ratings are based on visual inspections conducted in September 2023 and August 2024 by HDR.

6 Proposed Drainage Improvement Projects

Because of scope limitations, only five potential drainage improvement projects (DIPs) with cost estimates were developed for this master plan. The five that were selected were all top rated in the prioritization criteria, and from those top projects, the City's and community's input were used. Advancing the remaining potential drainage improvement projects is also recommended, as resources and funding can be identified and secured.

These five projects were moved to the conceptual design level—a level of design that describes the purpose and need of the improvement project, considers high-level impacts, and provides a high-level cost estimate that can be used to further project development. Conceptual figures of the DIPs are provided in Appendix F.

6.1 Kachemak Street Drainage

Summary: This project will improve roadway drainage and winter maintenance on Kachemak Street by installing a new stormwater system and paving an inverted roadway.

Description: Kachemak Street is a 17 to 18-foot wide, gravel road that collects surface flow from the roadway and adjacent residences. Additionally, limited right-of-way (ROW) and steep vertical roadway curves are noted to cause drainage and snow removal constraints. Resident concerns, City focus, and field inspections have noted areas of ineffective drainage on Kachemak Street that cause roadway rutting and water ponding.

This project will pave Kachemak Street, from Willow Street to Airport Avenue, with an inverted roadway crown to drain surface flows toward the center of the road. A new stormwater system will be centered on the road and collect flows via two inlet grates. These inlets will be piped and outlet to Seldovia Sough. This inverted crown and centered inlet design has been implemented successfully on Lipke Lane.

Other design considerations include roadway width requirements, utility mainline conflicts (water and sanitary sewer), residential utility connections, and limited ROW. A water main (10-inch, thin-wall, steel pipe) runs down the east side of Kachemak Street with residential connections. The crown of the water main is at an approximate minimum depth of 3.5 feet (CRW 2008). A sanitary sewer main runs down the west side of Kachemak Street with residential connections. The crown of the sanitary sewer main is at an approximate minimum depth of 4.5 feet (CRW 2008).

Estimated design and construction costs are provided in Table 7.

O&M: Similar to existing conditions, normal roadway maintenance is required. Routine street sweeping will be required to maintain an effective drainage path.

Table 7. Kachemak Street Drainage Design and Construction Cost Estimate

Kachemak Street Drainage	
Task	Estimate
Survey	\$35,000
Engineering & Design	\$65,000

Kachemak Street Drainage	
Task	Estimate
Construction	\$457,000
Total Cost Estimate	\$557,000

Notes: Based on 2024 prices. Cost estimate does not include construction assistance.

6.2 Main Street Drainage

Summary: This project aims to improve surface drainage, filter pollutants, provide temporary storage of stormwater, and provide beautification through the implementation of new sediment basins.

Description: Main Street contains the majority of Seldovia's store fronts, is one of the first things experienced by visitors off the ferry and is frequented by locals. Resident concern, City focus, and field inspections have noted areas of significant stormwater ponding in gravel parking lots along Main Street at the municipal boat launch located adjacent to the Seldovia Liquor Store (275 Main Street) and in front of the Gateway Pavilion (187 Main Street).

The municipal boat launch is used for boat launching, boat storage, and snow storage. The lot is noted to have poor drainage and the existing field inlet, MNS-S-003, is located in an adjacent grassy swale that requires regrading to drain effectively. Snow removal activities have been noted to rut the gravel parking lot and increase the melt water's sediment load. This project proposes to remove the existing MNS system and reconstruct a new system, as summarized below:

- The proposed curb inlet on the north side of Main Street (replacing MNS-S-001) will be relocated to the low spot in the road.
- The curb inlet on the south side of Main Street will be replaced and stay in the same location.
- The field inlet in the swale (replacing MNS-S-003) will be relocated to the low spot to collect melt water and stormwater from the gravel parking lot.
- The gravel parking lot will be regraded to drain to the sediment basin, and the system will outlet to Seldovia Bay.

The Gateway Pavilion public facility and the City's short-term gravel parking lot are located at the intersection of Main Street and Airport Avenue. Significant stormwater ponding has been noted due to the existing inlets not being in the low spot and a general lack of inlets (PEN stormwater system). This project proposes to construct a new system with sediment basins. The new system will include:

- A new curb inlet in front of 198 Main Street.
- A new sediment basin with a field inlet collecting surface flows from in front of the pavilion.
- A new sediment basin with a field inlet collecting surface flows from the gravel parking lot.
- Regrading of the parking lot to drain towards the sediment basins.
- The system will outlet to Seldovia Bay and leave in place the Peninsula Street system that outfalls nearby.

The proposed sediment basins will use green infrastructure techniques consisting of a depressed vegetated area with appropriate plants and permeable soil that will surround a raised field inlet (see

Figure 2). The space will promote infiltration and temporary storage of stormwater, while also conveying stormwater during higher flows through the raised field inlet. If soil conditions are found to be conducive, the sediment basins may also allow for stormwater infiltration.

Estimated design and construction costs are provided in Table 8.

O&M: Periodic maintenance is important to the long-term design and use of sediment basin facilities. Maintenance recommendations include seasonal vegetation maintenance (pruning, tilling, weeding, mulching, and amending soil), watering, trash and debris removal, inspection and repair of eroded soil, and removal of litter and debris. Commonly, sediment basin infrastructure requires more frequent maintenance until plants are established and then less maintenance over the long term. Occasionally, likely once every few years, sediment and debris will need to be removed from stormwater structures and pipes.

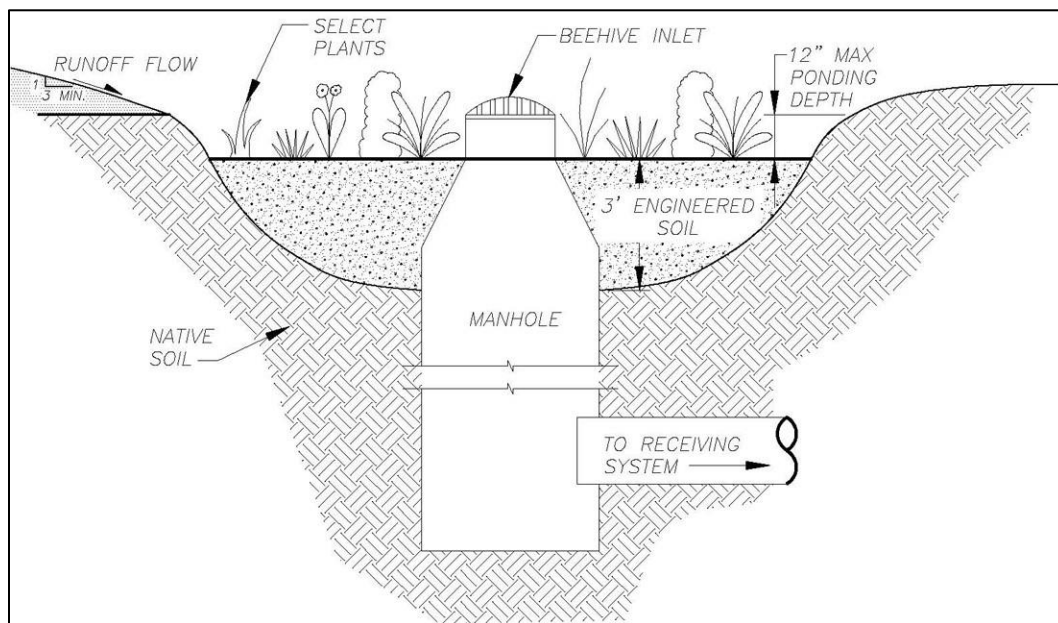


Figure 2. Conceptual Sketch of Sediment Basin and Overflow Structure Cross Section

Image Source: MOA 2017, Figure 6.6-2.

Table 8. Main Street Drainage Design and Construction Cost Estimate

Main Street Drainage	
Task	Estimate
Survey	\$50,000
Engineering & Design	\$70,000
Construction	\$208,000
Total Cost Estimate	\$328,000

Notes: Based on 2024 prices. Cost estimate does not include construction assistance.

6.3 Frank Raby Drive Drainage

Summary: This project aims to improve existing stormwater ditches and install new cross drainage culverts along Frank Raby Drive and Rocky Street to improve surface flow.

Description: The RKY and FKR drainage systems drain the roadway and residential lots. Surface drainage from Rocky Street has been noted to overtop the road at FKR-P-001. Additionally, limited ROW for ditch lines and flat topography compound drainage issues further.

This project proposes to redirect flow from Rocky Street by:

- Removing RKY-P-001 and relocating its flow to the east side of Frank Raby Drive.
- Widening and cleaning the ditch lines along Frank Raby Drive to allow for adequate ditch capacity.
- Adding a driveway cross-drainage culvert to allow drainage and access for the property along the east side of Frank Raby Drive.
- Replacing FKR-P-001 and FKR-P-002 with downsized driveway cross-drainage culverts to ensure adequate cover and drainage for the decreased contributing drainage area.
- Replacing FKR-P-005.

Estimated design and construction costs are provided in Table 9.

O&M: Similar to existing conditions, normal gravel roadway maintenance is required. Ditch lines should be cleaned of excess vegetation, trash, and debris as needed.

Table 9. Frank Raby Drive Drainage Design and Construction Cost Estimate

Frank Raby Drive Drainage	
Task	Unit Price
Survey	\$18,000
Engineering & Design	\$40,000
Construction	\$86,000
Total Cost Estimate	\$144,000

Notes: Based on 2024 prices. Cost estimate does not include construction assistance.

6.4 City-Wide Sediment Basin Study

Summary: This project aims to improve surface drainage, filter pollutants, provide temporary storage of stormwater, and provide beautification through the implementation of new sediment basins in key locations around the City. Based on a 2024 drainage and stormwater survey, community members ranked this project the highest priority.

Description: During the 2023 and 2024 visual inspections, sediment accumulation was commonly seen in curblines, around inlets, and in stormwater pipes. Street sweeping is conducted annually in spring and collects the gravel used for winter snow traction (1 inch minus material). However, due to the numerous gravel roads and driveways, sediment continues to be tracked and transported. Snow storage areas accumulate sediment that can be resuspended by surface flows and end up in

receiving waters. This project will determine sediment basin locations and designs to decrease the stormwater volume and sediment load to receiving waters.

Potential locations for sediment basins within the City were investigated. Parcels identified are near an existing drainage system outlet and large enough to accommodate a sediment basin. Current property ownership was also taken into consideration and is discussed for each potential location. Three potential land parcels were identified (Main Street Drainage DIP also proposes separate sediment basin projects.):

- **FKR:** The FKR system outlets onto a state-owned parcel at the northeast corner of Jack Thomas Circle and Airport Avenue. Flows then enters the Seldovia Slough. A sediment basin would settle surface flow sediment coming from Frank Raby Drive and Airport Avenue. Coordination with the State of Alaska would be required.
- **Spring Street:** Spring Street provides downstream drainage for VIS and the north end of Main Street. Drainage that collects in the ditch lines in front of the City's boat yards would increase capacity and settle sediment before discharging to Inside Beach via Spruce Street (SPU). A City parcel in the area could be feasible to use. Water and sanitary sewer utility conflicts would need to be evaluated.
- **WIN:** Flow from the north settles into the low spot where Winifred Avenue and Anderson Way converge. A small sediment basin could be implemented within the road shoulder to collect and infiltrate surface flows. Coordination with the State of Alaska would be required.

Estimated study costs are provided in Table 10.

O&M: Periodic maintenance is important to the long-term design and use of sediment basins. Maintenance recommendations include twice annual (after spring snowmelt and before first snowfall) routine inspections, erosion repair, clearing of flow paths, and trash/debris removal. Sediment removal from the basin should be conducted every 5 to 25 years as needed. Occasionally, likely once every few years, sediment and debris will need to be removed from stormwater structures and pipes.

Conceptual Sketch: See Section 6.2 Main Street Drainage conceptual sketch.

Table 10. Estimated Costs for City-Wide Sediment Basin Study

City-Wide Sediment Basin Study	
Task	Estimate
Engineering Study	\$70,000
Public Involvement	\$8,000
Total Cost Estimate	\$78,000

Notes: Based on 2024 prices.

6.5 Vista Avenue Drainage

Summary: This project aims to improve existing stormwater ditches and install new cross drainage culverts along Vista Avenue to improve surface flow.

Description: The VIS drainage system drains a portion of the Susan B. English School lot, residential lots, and the City boat yards. Surface drainage from the school has been noted to impact residences along Vista Avenue. The City recently replaced corroded water lines, which is an issue unique to this area. During the 2023 and 2024 visual inspections, surface drainage was seen to contain a large amount of orange flocculant, indicating the possibility of iron-oxidizing bacteria.

This project proposes to replace the majority of the system as follows:

- A new ditch line will be installed along the northeast side of Vista Avenue to collect surface flows from the school and roadway.
- Two new cross culverts will tie into the existing ditch line along Spring Street and outlet to Inside Beach.
- The shallow swales on Main Street, in front of the City boat yards, will be improved to collect surface flows and direct them to the Spring Street ditch line.
- The existing VIS-P-003 will be replaced and designed with adequate cover.
- The Spring Street ditch line should also be cleaned of excess vegetation, trash, and debris to ensure adequate flow passage downstream.

Estimated design and construction costs are provided in Table 11.

O&M: Similar to existing conditions, normal gravel roadway maintenance is required. Ditch lines should be cleaned of excess vegetation, trash, and debris as needed.

Table 11. Vista Avenue Drainage Design and Construction Cost Estimate

Vista Avenue Drainage	
Task	Estimate
Survey	\$18,000
Engineering & Design	\$40,000
Construction	\$47,000
Total Cost Estimate	\$105,000

Notes: Based on 2024 prices. Cost estimate does not include construction assistance.

In addition to the five DIPs, O&M and long-term recommendations for all the existing drainage systems are summarized in Table 12.

Table 12. Stormwater Infrastructure Recommendations

Stormwater System	Location	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
KAK	Kachemak Street	80	-	Kachemak Street Drainage Improvements: This project will improve roadway drainage and winter maintenance on Kachemak Street by installation of a new stormwater system and paved, inverted roadway crown.	Yes
MNS	Main Street	80	Routine street sweeping.	Main Street Drainage Improvements: Facility #1: This project aims to improve surface drainage, filter pollutants, provide temporary storage of stormwater, and provide beautification through the implementation of a sediment basin along Main Street near the municipal boat launch. MNS-S-001 and MNS-P-001 are to be removed; MNS-S-002 is to be added; and MNS-P-002, MNS-S-003, MNS-P-003, and MNS-S-004 are to be removed and replaced.	Yes
FKR	Frank Raby Drive	70	-	Frank Raby Drive Drainage Improvements: This project will improve roadway drainage on Frank Raby Drive by installing new cross culverts; removing and replacing culverts FKR-P-001, FKR-P-002, and FKR-P-005; removing culvert RKY-P-001; and improving ditches. Flow down Rocky Street will be diverted down the east side of Frank Raby Drive after the removal of RKY-P-001 and installation of new culverts.	Yes
PEN	Peninsula Street	70	-	Main Street Drainage Improvements: Facility #2: This project aims to improve surface drainage, filter pollutants, provide temporary storage of stormwater, and provide beautification through the implementation of a sediment basin along Main Street at the Gateway Pavilion in addition to a new piped stormwater system.	Yes
RKY	Rocky Street	70	-	(See section for FKR.)	-
-	Citywide (Sediment Basin)	60	-Acquire a Street Sweeper with Curb Brooms. -Acquire a Vacuum Truck-Super Sucker/Dry Vac with Jetter. -Perform more frequent and effective street sweeping.	-Sediment Basin Study: This project will further develop sediment basin design and implementation in key locations within the City to reduce the sediment load in stormwater flows being discharged to receiving waters. Suspended sediment in stormwater can result in undesirable water quality impacts such as increased turbidity and pollutants. Over time, sediment accumulation in the stormwater system can reduce system capacity and require additional maintenance. Initial suggestions include FKR, SPG, and WIN. -Citywide Regrading and Relocating Inlets: Recommends rehabilitating the drainage paths to existing stormwater inlets and, in some cases, relocating stormwater inlets to provide more effective roadway drainage. -Stormwater Manhole and Inlet Markers: Recommends replacing stormwater manhole covers and adding signage to stormwater inlet grates to alert and remind individuals that flows that enter the stormwater system flow directly to downstream waterbodies.	Yes

Stormwater System	Location	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
ARP	Airport Avenue	60	Routine street sweeping for paved portion.	-Include ARP-S-004 in Citywide Regrading and Relocating Inlets. -Replace ARP-P-005; coordinate with DOT&PF.	-
VIS	Vista Avenue, Main Street	60	-	-Obtain drainage easement for drainage and stormwater infrastructure located on private property. -Vista Avenue Drainage Improvements: This project aims to rehabilitate stormwater existing ditches and swales and remove and replace cross-drainage culvert VIS-P-002 along Vista Avenue to mitigate surface and groundwater flow impacts on residences and downstream infrastructure. In conjunction with a water quality study, it would attempt to mitigate the corrosion issues that have been occurring in this area.	Yes
WTR	Water Supply Road	60	Routinely clean out ditch lines.	Add a new ditch from the North Rocky Ridge Trailhead to the water storage tank.	-
ALD	Alder Street	50	Routine street sweeping for paved portion.	-	-
BAY	Bay Street	50	-	-	-
BYD	City Boat Yard, Main Street	50	-	-	-
SEL	Seldovia Street, Main Street	50	Routine street sweeping.	-	-
WIN	Winifred Avenue, Alder Street, Anderson Way	50	-	-Re-establish drainage ditches along the front of the school. -Replace WIN-P-001. -Replace WIN-P-002; coordinate with DOT&PF.	-
AND	Anderson Way	40	-	Replace AND-P-002.	-
CST	C Street	40	-	-Recommend obtaining drainage easements for drainage and stormwater infrastructure located on private property. -Replace cross-drainage driveway culverts CST-P-002 and CST-P-004.	-
ENG	English Drive	40	-	-	-
FUL	Fulmor Avenue, Alder Street, Main Street	40	Routine street sweeping.	-	-

Stormwater System	Location	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
SHL	Shoreline Drive	40	Routinely clean out drainage notches in retaining wall.	-Regrade road to drain towards SHL-P-001 and ditch. - Add cross-culvert drainage along Shoreline Drive between Malcolm Street and Young Street. -Add a new swale along the north side of Malcom Street. -Replace SHL-P-002. Additional survey is required to determine if the pipe could be raised above tidal influence.	-
AIR	Seldovia Airport	30	-	Support proposed Airport Improvement Project.	-
AUG	Augustine North Avenue	30	-	-	-
BLC	Bloch Street	20	-	Add a swale along the north side of Bloch Street.	-
DST	D Street	20	-	-	-
HBR	Harborview Drive	20	Routine street sweeping.	-	-
ILI	Iliamna Street	20	-	-	-
LIP	Lipke Lane	20	Routine street sweeping.	-	-
YNG	Young Street	20	-	-Re-establish upstream and downstream ditch line. -Upsize and replace YNG-P-001.	-
AST	A Street	10	-	-	-
BST	B Street	10	-	Obtain a drainage easement for drainage and stormwater infrastructure located on private property.	-
LSU	Lake Susan, Lake Street, Kachemak Street	10	-	Add an additional inlet just west of the Lake Street and Shoreline Drive intersection and tie it into LSU.	-
SPG	Spring Street	10	Routinely clean out ditch line.	-	-
SPU	Spruce Street	10	-	-	-
WIL	Willards Way	10	-	-	-

Notes: Sorted by Prioritization Score. DIP = Drainage Improvement Project.

7 General Stormwater Recommendations

Based on Alaska and national stormwater best practices, general stormwater recommendations for Seldovia are summarized below.

7.1 Planning, Design, and Construction

- Start long-term planning for drainage easement acquisitions to allow for improved drainage and snow removal management. Review and revise plan every 3–5 years. Continue long-term plans for replacing aging infrastructure to reduce failures and emergency repairs. Review and revise plan every 3–5 years.
- Draft residential and commercial guidelines or regulations for new development aimed to reduce future impacts to stormwater and receiving waterbodies from these activities. Draft site development measures for planning, design, and construction of sites. Include ways to increase pervious area, contain stormwater flows on site, and utilize green infrastructure.
- Develop green infrastructure guidance (such as a checklist) for assessing feasibility of green infrastructure in proposed projects. Recommend using general green infrastructure resources from EPA (EPA 2024a) and ADEC's Alaska Stormwater Guide (ADEC 2011). Recommend reviewing local manuals, such as the MOA's Anchorage Stormwater Manual (MOA 2017) and the Fairbanks Soil & Water Conservation District's Green Infrastructure Project Guide (Fairbanks 2015) for framework.
- In the planning phase of a proposed project, determine if there will be impacts to any ADEC Contaminated Sites and, if so, develop measures to complete cleanup or mitigate pollution spread.
- Work with community partners, such as DOT&PF and SVT, to coordinate improvement projects, pursue joint funding opportunities, and reduce stormwater impacts on downstream receiving waters.
- Review water quality data to determine knowledge gaps and how those gaps could impact the stormwater system. If needed, develop a monitoring plan to reduce knowledge gaps.
- Implement proposed DIPs.
- Install stormwater manhole covers and add signage to stormwater inlet grates to alert and remind individuals that flows that enter the stormwater system flow directly to downstream waterbodies. Stormwater drain marking aim to discourage practices that generate stormwater pollutants by increasing public awareness of urban runoff. Existing stormwater manhole covers should be replaced with new manhole covers that read "STORM – DRAINS TO WATERWAY" or similar. Existing stormwater inlet grates should be modified with an emblem that reads "NO DUMPING – DRAINS TO WATERWAY" or similar.

7.2 City Code, Building Requirements, and Land Use Management Plan

The City's Code of Ordinances currently has minimal stormwater related codes. *Title 13 – Utilities* does state that it is unlawful to discharge to several public water flows, including sewer storm, rainwater, roof run-off, and subsurface waters (City 2024). It is recommended to develop further stormwater regulations for planning, design, and construction guidance. *Title 2 – Administration and Personnel* provides the governance for who and how a new ordinance may be brought forward (City

2024). An ordinance may be introduced by a member or committee of the Council, the Mayor, or the City Manager and must be sponsored to be introduced and placed on the agenda. Comparable cities' codes can be used as a framework for developing stormwater ordinances and summaries of stormwater code from Sitka and Homer are provided below.

7.2.1 City and Borough of Sitka

The City and Borough of Sitka's (CBS) General Code has a storm drainage chapter (Chapter 15.30) that outlines the purpose, applicability, and administration of the chapter's content, as well as the function of the CBS design and construction standards for storm drainage improvements and the delineation of Special Drainage Use Zones. The chapter applies to all public and private property within the CBS. Standards specifications include construction and design standards for culverts, catch basins, drains, ditches, drainage inlets, and other ordinary drainage improvements. Stormwater design standards include design standards for hydrologic and hydraulic design and sizing of culverts, drains, ditches, drainage inlets, and other ordinary drainage improvements. Special Drainage Use Zones are defined as areas within the city that are critical or may reasonably become critical to the passage of stormwater runoff from upland origins. The full chapter can be found on CBS's website (CBS 2023).

7.2.2 City of Homer

The City of Homer has stormwater development guidance within Chapter 21 of their City Code. This chapter provides regulation on Development Activity Plans (Chapter 21.74) and Stormwater Plans (Chapter 21.75), which are required for planned property development within city limits. Both require information on the control of stormwater discharges, total suspended solids, and other pollutants carried in runoff. Development Activity Plans are generally for smaller, less-complex projects, whereas Stormwater Plans are generally for larger, more complex projects. Stormwater Plans require a professional civil engineer licensed in the state of Alaska to prepare and stamp them. The plans' specifics and full chapter can be found on Homer's website (Homer 2024).

7.3 Operations and Maintenance

To ensure that stormwater systems continue to properly function, yield expected water quality, provide environmental benefits, and protect public safety, appropriate O&M activities are required.

7.3.1 Roadways

- Acquire fleet equipment to aid in stormwater O&M activities. Acquire new street sweeper to assist in the maintenance of the City's paved streets and sidewalks to reduce the sediment load in stormwater flows being discharged to receiving waters. Acquire new Vactor truck (Super Sucker or Dry Vac), with an attached jetter, for the repair and maintenance of City infrastructure.
- Develop an O&M plan and schedule for drainage infrastructure. Incorporate pollution-preventing procedures into O&M activities of roads and bridges. Continue street sweeping and vacuum maintenance of storm infrastructure to reduce sediment loads conveyed through the drainage system. Include green infrastructure maintenance recommendations.
- Implement sediment control measures to reduce sediment loads conveyed through the drainage system. Incorporate maintenance of sediment control measures into O&M plan and schedule.



- Provide new O&M operators with grading and snow plowing training through proper on-the-job training or Alaska-based training opportunities.
- Implement stormwater erosion and sediment controls during construction and earth disturbing work to prevent or control stormwater runoff.
- Continue agreement with DOT&PF on collaborative roadway maintenance.
- Encourage leak and spill prevention. Encourage facilities and operations to document and report spills to proper authorities. Alaska state law requires all oil and hazardous substance releases to be reported to ADEC. Instructions on how and when to report a spill are provided on ADEC's website (ADEC 2025).

7.3.2 Snow Storage and Disposal

ADEC guidance for snow disposal on marine ice and in open marine waters is summarized below (ADEC 2024a).

- Continue agreements with DOT&PF and SVT on snow storage, snow disposal, and sanding.
- For small communities bordering the seacoast, such as Seldovia, it is permissible to place clean, freshly fallen snow from adjacent parking lots and streets into marine waters.
- Dispose of snow in open water with adequate mixing to prevent ice dams from forming.
- Do not dispose of snow in saltmarshes, vegetated wetlands, shellfish beds, mudflats, Special Management Areas designated by state or federal resource agencies, or areas of critical environmental concern.
- Do not dispose of snow where trucks may cause shoreline damage or erosion, or within areas of green infrastructure practices.
- Remove accumulated trash and debris from the disposal area as they become visible. Debris in surface water is a water quality violation. Wastes and litter that become uncovered as the snow melts need to be picked up before off-site migration of the waste becomes a problem.
- Under emergency or extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed in certain waterbodies under certain conditions. In these dire situations, the ADEC Division of Water must be notified before disposing of snow in a waterbody.

7.4 Harbor and Boating Activities

- Conduct a best practice assessment of the Seldovia Boat Harbor and boat yard using Alaska Clean Harbors' (ACH) checklist (ACH 2025a).
- Develop a Storm Water Pollution Prevention Plan (SWPPP) for the harbor and boat yard.

7.5 Community Involvement

- Stormwater education and outreach to mitigate current and future water quality issues through public awareness. Education and outreach can include informational sheets at problem locations, signage at proposed or on-going projects, school programs and activities, and information shared on the City's website and social media platforms. Recommend reviewing local and national groups focused on stormwater outreach, including Anchorage Waterways Council (AWC 2025) and EPA national resources (EPA 2025).

- Install a green infrastructure pilot project in a public space to enhance community beautification and increase community interest in green infrastructure.
- Provide green infrastructure resources for community and private property owners. Consider including information on backyard rain gardens, rain barrels, native planting recommendations, maintenance checklist, or similar. Consider providing grants or other incentives to boost interest.
- Develop “Adopt-a-drain” and “Adopt-a-rain-garden” programs. Reach out to teachers, volunteer groups, and local environmental-focused organizations for collaboration.
- Collaborate with the school to promote classroom curriculum on the water cycle, stormwater, nonpoint source pollution, good stewardship, and green infrastructure.

8 Benefits to the Waterbody

Stormwater can have lasting impacts on the downstream receiving waterbody. Through incorporation of stormwater guidance, improvement projects, and increased awareness, the following benefits to the Seldovia Bay waterbody may emerge:

8.1 Planning, Design, and Construction

- Stormwater planning and management can reduce pollution and runoff, maintaining or improving the water quality downstream.
- Stormwater preventative measures during construction can reduce the potential of flooding, erosion, and pollution that could violate a permit and protects the water quality downstream.
- Development of a water quality monitoring plan would allow for the identification and reduction of knowledge gaps about the watershed’s water quality. If concerns arise, further action is recommended to reduce downstream impacts.
- Proposed DIPs are aimed to improve existing drainage flow, increase temporary stormwater storage, and retain sediment.

8.2 City Code, Building Requirements, and Land Use Management Plan

- Stormwater management can be strengthened through regulation to develop and maintain a baseline of stormwater management through concise and consistent local requirements. These regulations can maintain and potentially improve flows entering the downstream waterbody through requirements for future development.

8.3 Operations and Maintenance

- Following an O&M plan and schedule can improve drainage flow, reduce sediment conveyance, and increase the service life of the stormwater system.
- Acquisition of stormwater-related fleet equipment and scheduled use of the equipment (sweepers, snow removal) can significantly reduce sediment conveyance and loading to the downstream waterbody.

- Following ADEC Snow Disposal Information and Snow Disposal on Marine Ice and in Open Marine Water (ADEC 2024a) guidance can reduce pollutants introduced to the downstream waterbody.

8.4 Harbor and Boating Activities

- Development and use of a harbor and boat yard SWPPP improves stormwater pollution mitigation and emergency response efforts.

8.5 Community Involvement

- Community education and outreach about stormwater management can increase interest, awareness, and management efforts that can have long-term, positive impacts to the downstream waterbody.

9 Partnership Programs

Collaboration with other community partners may provide additional programs, resources, and funding opportunities. Identified partnership programs are provided below. Additional programs can be found in Appendix C of ADEC's Alaska Nonpoint Source Water Pollution Prevention and Restoration Strategy report dated May 2020 (ADEC 2020).

ADEC: ADEC broadly covers environmental components for Alaska, including drinking water, wastewater, water resources, shoreline management, toxic cleanup, and more. In locations where multiple environmental components need improvement, grant funding and low interest loans may be able to be leveraged to extend value (ADEC 2024c).

- **ACWA** creates a cooperative method (ADEC, Alaska Department of Fish & Game, and Alaska Department of Natural Resources) to collect information and direct resources to prevent or correct water quality problems. It also can be used to identify areas where pollution prevention and watershed planning efforts are encouraged to protect or improve water quality. ACWA requests proposals every other year for projects using funds that are passed through from federal monies. Seldovia received a 2023–2025 ACWA grant and is pursuing 2025–2027 grants.
- The **State Revolving Fund Program** is comprised of the Clean Water State Revolving Fund and Drinking Water State Revolving Fund. Annually, EPA provides ADEC grant funding to provide low-interest loans for water and wastewater infrastructure improvement projects, as well as activities to protect public health and achieve or maintain compliance with the Clean Water and Safe Drinking Water Acts. Loans can finance up to 100 percent of a project's eligible costs for planning, design, and construction of publicly owned facilities, as well as some privately owned facilities. Loans can also serve as local match for most other federal or state funding sources. At least 10 percent of the state's program must be used for eligible nonpoint source projects.
- **Village Safe Water** is working with rural communities to develop sustainable water and wastewater facilities. They assist with funding to small communities for water and sewer studies and construction projects through grant administration, project oversight, monitoring, and control.

ACH: ACH is an organization that involves harbor managers, communities, and boaters to implement pollution and waste best management practices at harbor facilities. The organization includes three certified harbors and four pledged harbors, including a pledge from Homer. Alaska Clean Harbors offers free technical assistance, tools, and resources but relies on the dedication of harbor and municipal staff to achieve shared goals of clean waterways (ACH 2025b).

DOT&PF:

- Continue **local collaboration of O&M activities** between Seldovia and DOT&PF through agreements, collaboration, and communication. The City and DOT&PF have agreements to share vehicles/equipment and divide snow removal and sanding within city limits.
- The **Safe Streets and Roads for All (SS4A) Grant Program** is administered by DOT&PF and funded by federal monies for 2022 through 2026. The program supports local initiatives to prevent death and serious injury on roads and streets. Seldovia received a 2023 congressional appropriation and 2024 state funding to resurface 2 miles of critical, unpaved road sections (DOT&PF 2024).

EPA: The Brownfields Program can provide direct funding or services for brownfields assessment, cleanup, revolving loans, environmental job training, technical assistance, training, and research. Brownfields are abandoned, unused, or underused properties that are hindered from desired reuse or redevelopment by real or perceived environmental contamination. Applicants may request EPA funding up to \$500,000 to address sites contaminated by hazardous substances (i.e., sites with potential contamination of hazardous substances, pollutants, or contaminants) and/or petroleum (i.e., sites with potential petroleum contamination). ADEC strongly supports and promotes the assessment, cleanup, and reuse of brownfields. ADEC can help identify brownfields, assess potential contamination, and assist in arranging necessary cleanup activities (EPA 2024b).

Homer Soil & Water Conservation District is one of 13 districts in Alaska that develop, manage, and direct natural resource programs at the local level. The organization is made up of private landowners and communities in partnership with state and federal agencies focused on agriculture, forestry, soils, and water. In the past, the City has collaborated with the Homer district on invasive species education. Potential future partnerships could cover education and programs focused on water quality, soil testing, and invasive species.

KPB: KPB and their community partners, including Seldovia, were awarded a 2022 **SS4A** grant from the Department of Transportation to complete a Comprehensive Safety Action Plan. This plan will identify opportunities to improve safety, especially for areas of highest concern (KPB 2025).

NOAA:

- The **Kachemak Bay National Estuarine Research Reserve (KBNERR)** supported by NOAA and its state partner, the Alaska Center for Conservation Science at the University of Alaska Anchorage (UAA), aims to promote conservation and stewardship in Kachemak Bay. They conduct research, monitoring, education, trainings, and community engagement and have developed a 5-year management plan. The City and SVT are involved with KBNERR (UAA 2025).
- The **National Coastal Resilience Fund** is a partnership between the National Fish and Wildlife Foundation and NOAA to enhance fish and wildlife habitat and protect coastal

communities. The program is supported by the Inflation Reduction Act, base appropriations, Department of Defense, other partner contributions, and has recently been boosted by Bipartisan Infrastructure Law funds. projects is on restoring, increasing, and strengthening natural infrastructure to protect communities while also enhancing habitats for fish and wildlife (NOAA 2025a).

- The **National Centers for Coastal Ocean Science** supports the **Competitive Research Program** to meet NOAA's coastal stewardship and management responsibilities by providing coastal managers with the scientific information necessary to decide how best to protect environmental resources and public health, preserve valued habitats, and improve the way communities interact with coastal ecosystems. Research focal areas are determined by engaging stakeholders and the scientific community through workshops, roundtables, and policy forums. In 2024, SVT with the City applied for a grant under this program to remove a fish passage barrier on Fish Creek (NOAA 2025b).

U.S. Department of Transportation – Federal Highway Administration (FHWA): Various competitive grants are available from the U.S. Department of Transportation and the FHWA for a variety of transportation projects (FHWA 2024):

- National Culvert Removal, Replacement, and Restoration Grants
- Rural Surface Transportation Grant Program
- Tribal High Priority Projects Program (coordination with SVT is required)
- Tribal Transportation Program Safety Fund (coordination with SVT is required)

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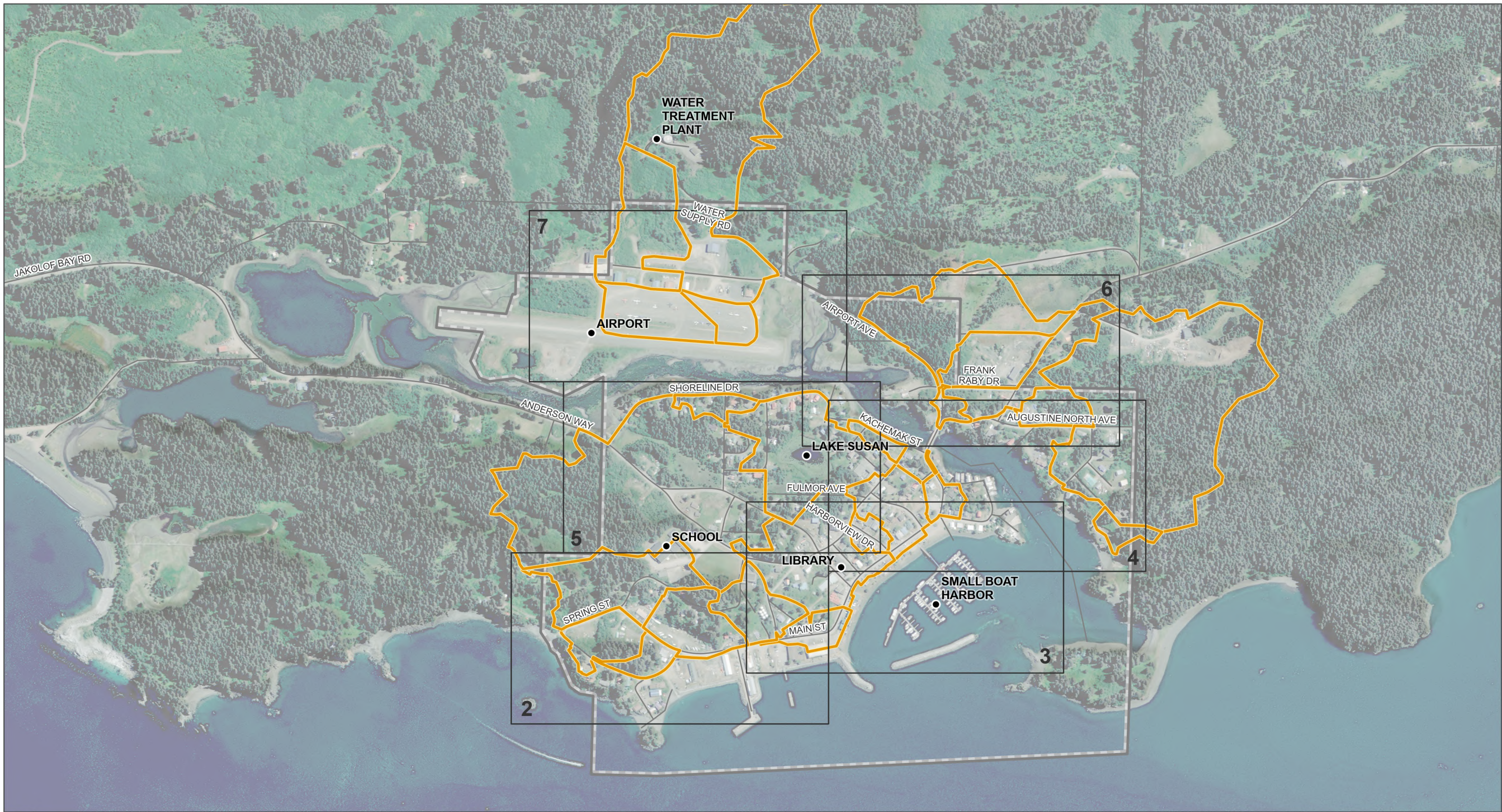
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Appendix A – Drainage Maps



LEGEND

Drainage Basin

Map Series Page

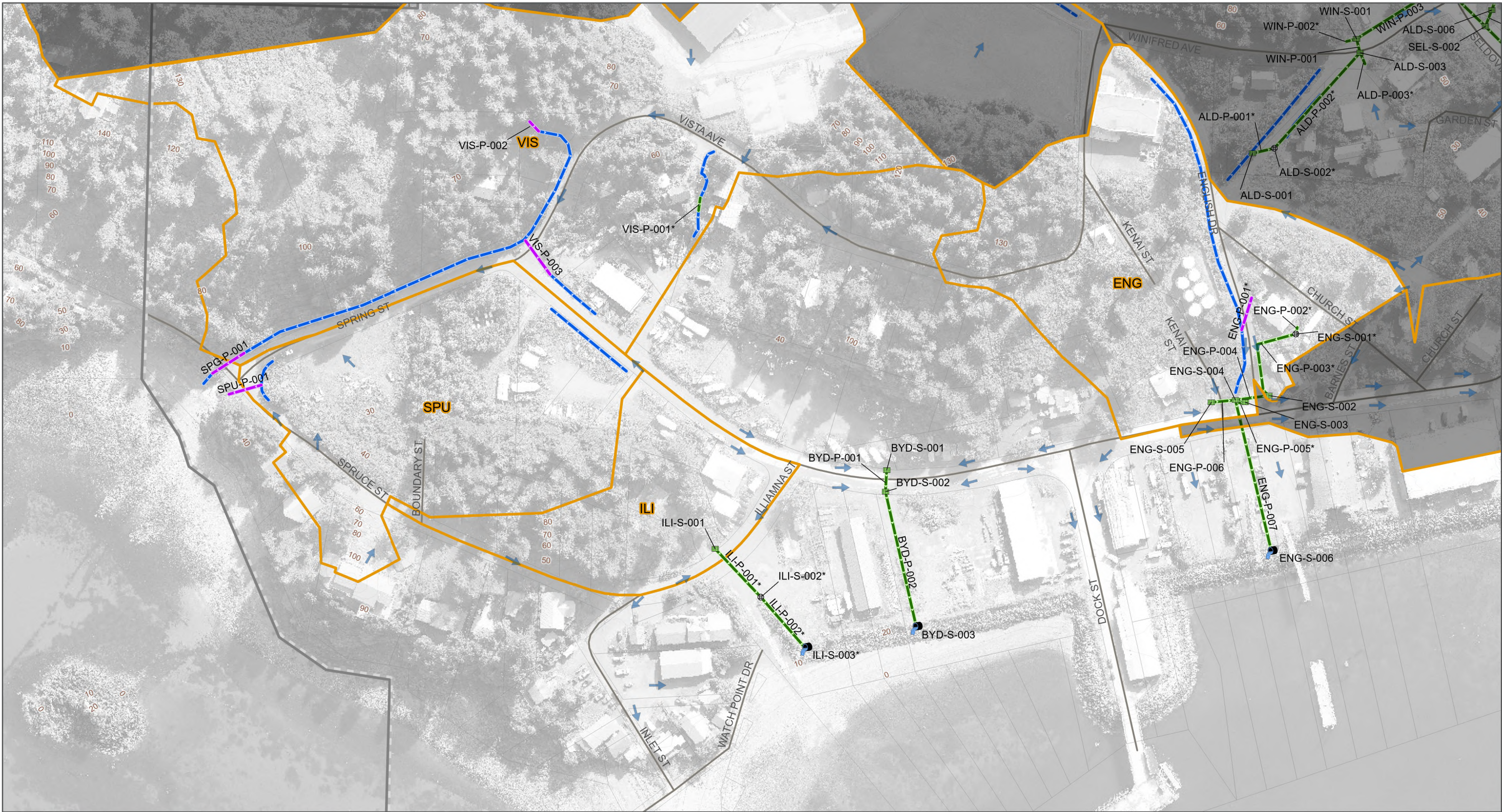
Seldovia City Limits

Roads

SELDOVIA STORMWATER DRAINAGE

OVERVIEW

Figure 1
2/20/2025



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
S-0XX	Structure
P-0XX	System Pipe or Culvert

Abbreviation	System
BYD	City Boatyard
ENG	English Drive
ILI	Iliamna Street
SPG	Spring Street
SPU	Spruce Street
VIS	Vista Avenue

*Location not field verified.
Additional investigations and precise survey should be
conducted for any future design or construction efforts.

0 150 Feet

SELDOVIA STORMWATER DRAINAGE

MAIN STREET - NORTH

Figure 2
2/20/2025



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
S-0XX	Structure
P-0XX	System Pipe or Culvert

Abbreviation	System
ALD	Alder Street
AND	Anderson Way
HBR	Harborview Drive
MNS	Main Street
SEL	Seldovia Street
WIN	Winifred Avenue

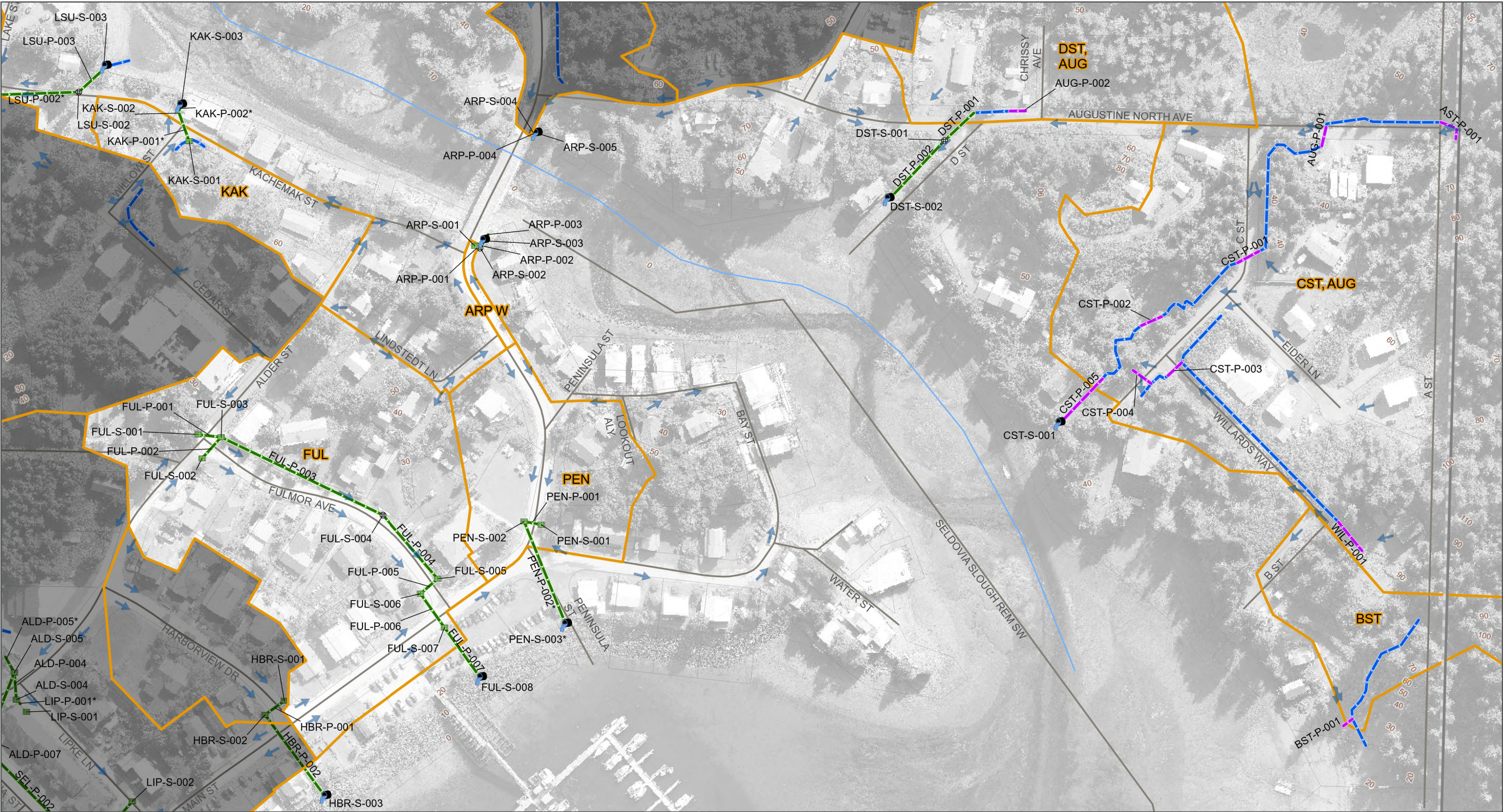
*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.

0 150 Feet

SELDOVIA STORMWATER DRAINAGE

MAIN STREET

Figure 3
2/20/2025



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
S-0XX	Structure
P-0XX	System Pipe or Culvert

Abbreviation	System
ARP	Airport Avenue
AUG	Augustine North Avenue
BST	B Street
CST	C Street
DST	D Street

Abbreviation	System
FUL	Fulmore Avenue
KAK	Kachemak Street
WIL	Willards Way
PEN	Peninsula Street

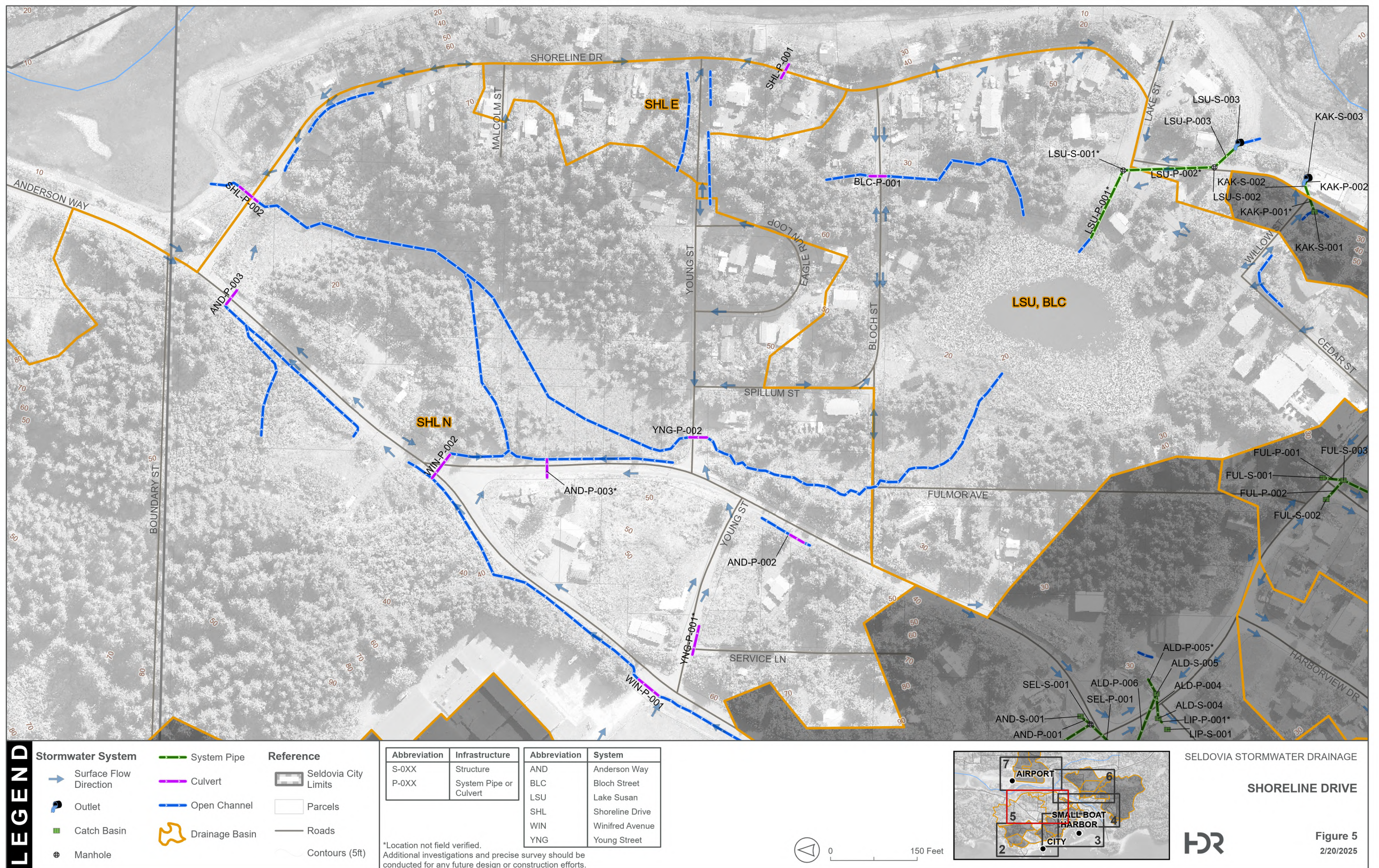
*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.

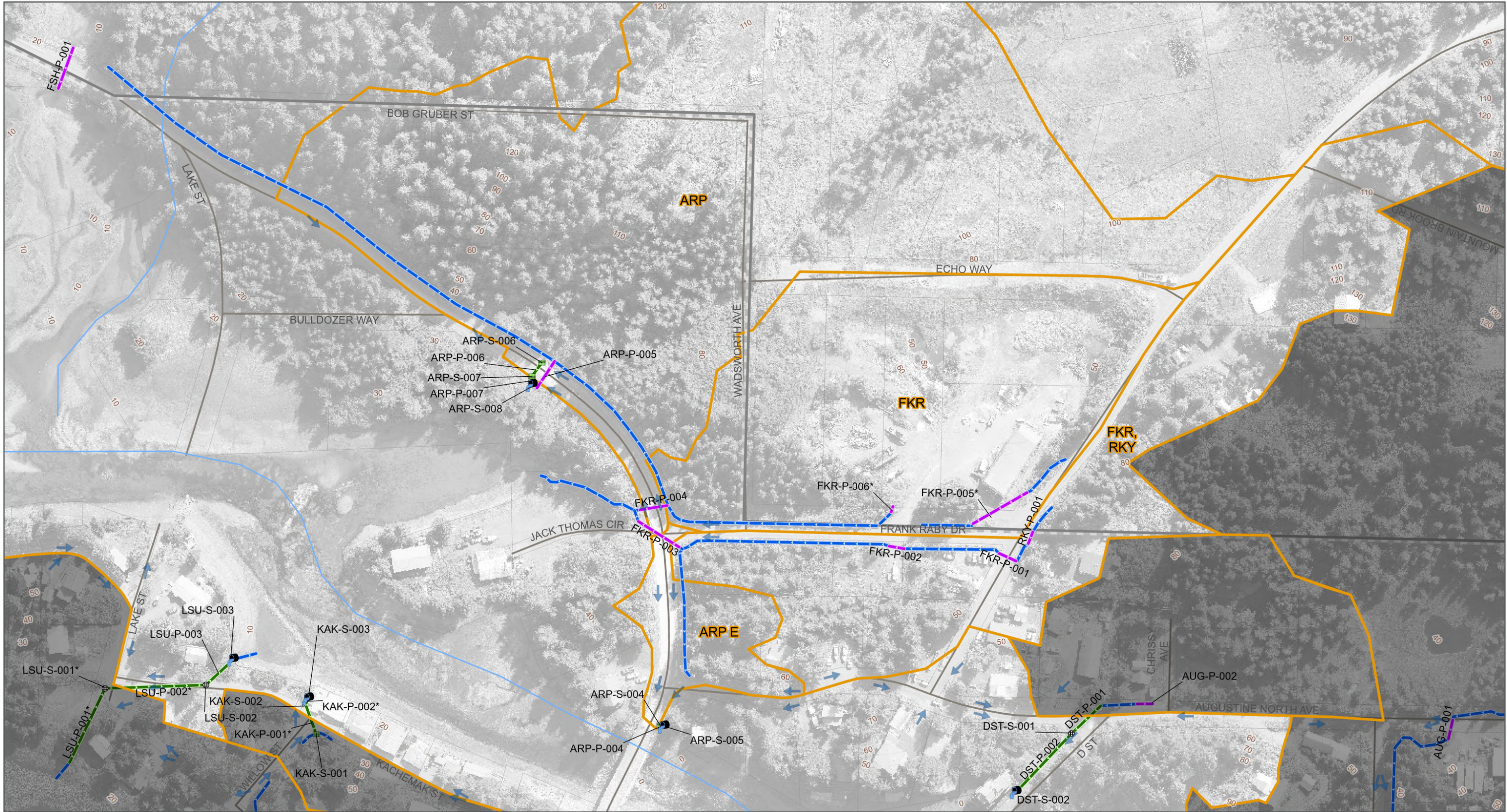
0 150 Feet

SELDOVIA STORMWATER DRAINAGE

MAIN STREET - SOUTH & EAST EDITION

Figure 4
2/20/2025





LEGEND

Stormwater System

- Surface Flow Direction
- Outlet
- Catch Basin
- Manhole

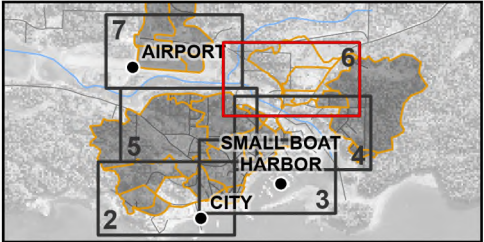
- System Pipe
- Culvert
- Open Channel
- Drainage Basin

Reference

- Seldovia City Limits
- Parcels
- Roads
- Contours (5ft)

Abbreviation	Infrastructure	Abbreviation	System
S-0XX	Structure	ARP	Airport Avenue
P-0XX	System Pipe or Culvert	FKR	Frank Raby Drive
		RKY	Rocky Street

*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.



SELDOVIA STORMWATER DRAINAGE

FRANK RABY DRIVE



Figure 6
2/20/2025

Appendix B – Hydrology Calculations

Project Name: Seldovia Stormwater Management Plan

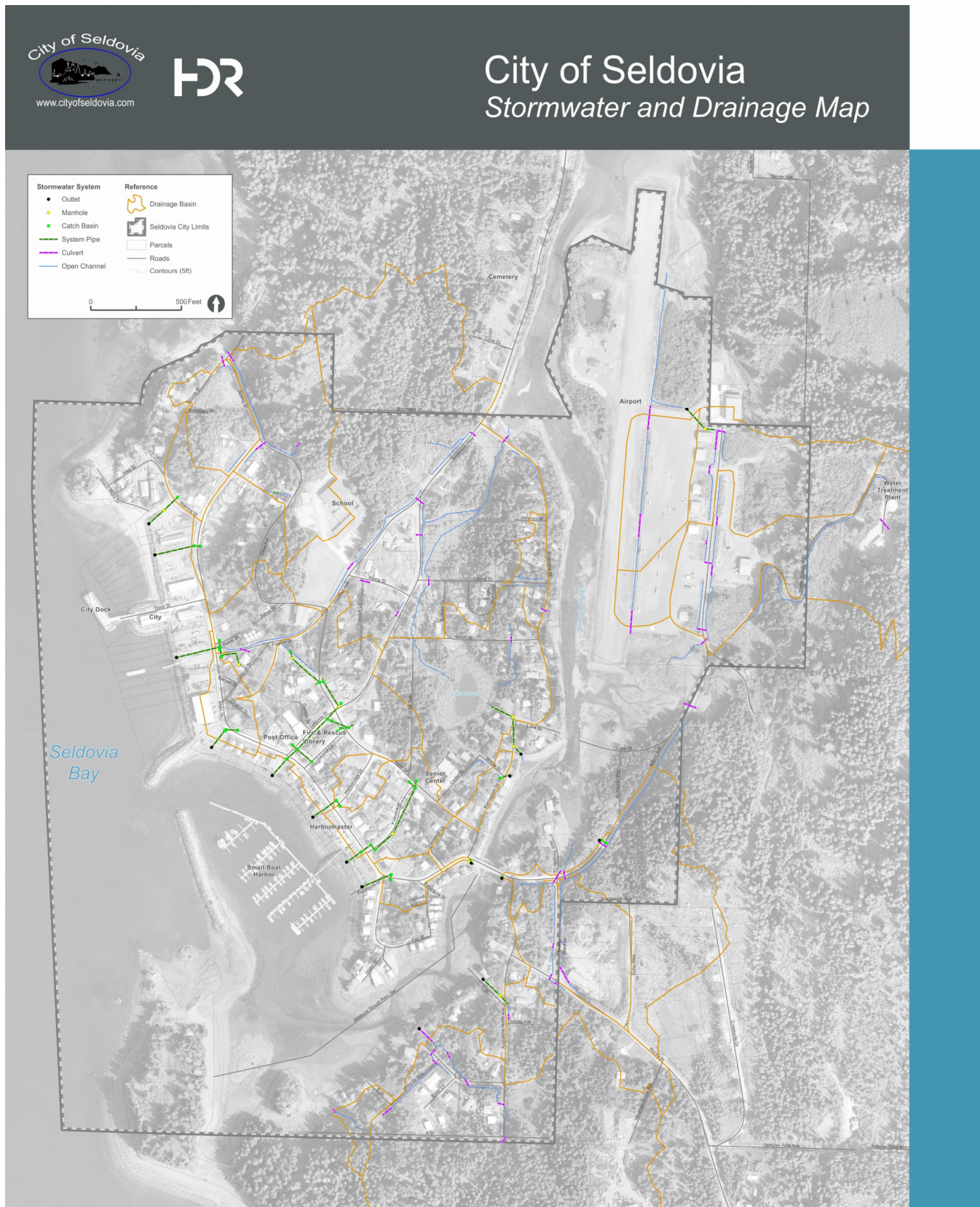
Updated: 11/13/24 J. Montoya

Step 1: Use basin size (ft²) to determine which peak flow calculation methods apply by basin size.

Stormwater System Basin	Location	Basin Size	Basin Size	Basin Size	Applicable Method
		ft ²	acres	mi ²	
ARP	Airport Avenue	591,187	13.6	0.021	Rational Method and/or TR-55
AIR NE	Airport NE	457,636	10.5	0.016	Rational Method and/or TR-55
AIR NW	Airport NW	280,634	6.4	0.010	Rational Method and/or TR-55
AIR SE	Airport SE	1,651,755	37.9	0.059	Rational Method and/or TR-55
AIR SW	Airport SW	114,893	2.6	0.004	Rational Method and/or TR-55
BST	B Street	67,737	1.6	0.002	Rational Method and/or TR-55
CST, AUG	C Street	1,879,811	43.2	0.067	Rational Method and/or TR-55
BYD	City Boat Yard	260,930	6.0	0.009	Rational Method and/or TR-55
DST, AUG	D Street	129,011	3.0	0.005	Rational Method and/or TR-55
ENG	English Drive	216,700	5.0	0.008	Rational Method and/or TR-55
FKR	Frank Raby Drive East	255,544	5.9	0.009	Rational Method and/or TR-55
FKR, RKY	Frank Raby Drive West	250,784	5.8	0.009	Rational Method and/or TR-55
FUL	Fulmore Avenue	238,075	5.5	0.009	Rational Method and/or TR-55
HBR	Haborview Drive	65,669	1.5	0.002	Rational Method and/or TR-55
ILI	Illiamna Street	89,018	2.0	0.003	Rational Method and/or TR-55
KAK	Kachemak Street	48,329	1.1	0.002	Rational Method and/or TR-55
LSU, BLC	Lake Street	636,522	14.6	0.023	Rational Method and/or TR-55
MNS	Main Street	112,154	2.6	0.004	Rational Method and/or TR-55
PEN	Peninsula Street	75,215	1.7	0.003	Rational Method and/or TR-55
ARP E	Seldovia Bridge E	41,073	0.9	0.001	Rational Method and/or TR-55
ARP W	Seldovia Bridge W	2,995	0.1	0.000	Rational Method and/or TR-55
SEL, ALD, LIP	Seldovia Street	567,473	13.0	0.020	Rational Method and/or TR-55
SHL E	Shoreline Dr. S	79,699	1.8	0.003	Rational Method and/or TR-55
SHL N	Shoreline Drive N	1,846,104	42.4	0.066	Rational Method and/or TR-55
SPG, VIS	Spring Street	458,371	10.5	0.016	Rational Method and/or TR-55
SPU	Spruce Street	188,840	4.3	0.007	Rational Method and/or TR-55

Basin falls within 2016 USGS Regression Equation parameters*Basin falls only within NRCS TR-55 Parameters*

Basin falls within Rational Method parameters and NRCS TR-55 parameters



Drainage basins shown in orange.

RATIONAL METHOD
Weighted Runoff Coefficients

Stormwater System Basin	Location	Basin Area (sqmi)	Basin Average Slope (%)	City Business Area			Commercial, Industrial			Dirt/Gravel Roads			Forest			Grassy Shoulder			Impervious		
				Description	Area	c	Description	Area	c	Description	Area	c	Description	Area	c	Description	Area	c	Description	Area	c
ARP	Airport Avenue	0.02	20.37	Hilly		0.95	Hilly	81,403	0.95	Hilly	33,856	0.72	Hilly	252,730	0.24	Hilly		0.3	Hilly	10,665	0.95
AIR NE	Airport NE	0.02	18.28	Hilly		0.95	Hilly		0.95	Hilly	57,338	0.72	Hilly	81,473	0.24	Hilly	37,150	0.3	Hilly	25,062	0.95
AIR NW	Airport NW	0.01	4.38	Rolling		0.95	Rolling		0.84	Rolling	247,100	0.66	Rolling		0.18	Rolling	33,533	0.3	Rolling		0.95
AIR SE	Airport SE	0.06	36.11	Hilly		0.95	Hilly		0.95	Hilly	220,134	0.72	Hilly	919,909	0.24	Hilly	27,284	0.3	Hilly	19,319	0.95
AIR SW	Airport SW	0.00	2.60	Rolling		0.95	Rolling		0.84	Rolling	108,115	0.66	Rolling		0.18	Rolling	6,779	0.3	Rolling		0.95
BST	B Street	0.00	29.56	Hilly		0.95	Hilly		0.95	Hilly		0.72	Hilly	20,920	0.24	Hilly		0.3	Hilly		0.95
CST, AUG	C Street	0.07	20.95	Hilly		0.95	Hilly	31,888	0.95	Hilly	70,413	0.72	Hilly	1,161,015	0.24	Hilly		0.3	Hilly	5,433	0.95
BYD	City Boat Yard	0.01	28.31	Hilly		0.95	Hilly	79,677	0.95	Hilly	8,995	0.72	Hilly	56,861	0.24	Hilly		0.3	Hilly	15,484	0.95
DST, AUG	D Street	0.00	16.82	Hilly		0.95	Hilly		0.95	Hilly	14,659	0.72	Hilly		0.24	Hilly		0.3	Hilly		0.95
ENG	English Drive	0.01	20.00	Hilly		0.95	Hilly	42,596	0.95	Hilly	15,177	0.72	Hilly	42,352	0.24	Hilly		0.3	Hilly	3,086	0.95
FKR	Frank Raby Drive East	0.01	20.02	Hilly		0.95	Hilly		0.95	Hilly	25,698	0.72	Hilly	19,125	0.24	Hilly		0.3	Hilly	2	0.95
FKR, RKY	Frank Raby Drive West	0.01	15.32	Hilly		0.95	Hilly		0.95	Hilly	28,336	0.72	Hilly	38,124	0.24	Hilly		0.3	Hilly	261	0.95
FUL	Fulmore Avenue	0.01	8.73	Rolling	62,111	0.95	Rolling		0.84	Rolling	5,618	0.66	Rolling	2,907	0.18	Rolling		0.3	Rolling	31,332	0.95
HBR	Haborview Drive	0.00	6.03	Rolling	3,718	0.95	Rolling		0.84	Rolling		0.66	Rolling		0.18	Rolling		0.3	Rolling	13,410	0.95
ILI	Illiamna Street	0.00	20.78	Hilly		0.95	Hilly	26,552	0.95	Hilly	13,018	0.72	Hilly	21,320	0.24	Hilly		0.3	Hilly	1,796	0.95
KAK	Kachemak Street	0.00	21.92	Hilly		0.95	Hilly		0.95	Hilly	9,550	0.72	Hilly		0.24	Hilly		0.3	Hilly		0.95
LSU, BLC	Lake Street	0.02	10.77	Hilly	21,391	0.95	Hilly		0.95	Hilly	42,158	0.72	Hilly	34,225	0.24	Hilly		0.3	Hilly		0.95
MNS	Main Street	0.00	14.14	Hilly	45,094	0.95	Hilly		0.95	Hilly	374	0.72	Hilly		0.24	Hilly		0.3	Hilly	21,940	0.95
PEN	Peninsula Street	0.00	14.23	Hilly	31,151	0.95	Hilly		0.95	Hilly	596	0.72	Hilly		0.24	Hilly		0.3	Hilly	14,218	0.95
ARP E	Seldovia Bridge E	0.00	21.74	Hilly		0.95	Hilly		0.95	Hilly	2,665	0.72	Hilly	22,885	0.24	Hilly		0.3	Hilly	9,450	0.95
ARP W	Seldovia Bridge W	0.00	3.37	Rolling	44	0.95	Rolling		0.84	Rolling		0.66	Rolling		0.18	Rolling		0.3	Rolling	2,951	0.95
SEL, ALD, LIP	Seldovia Street	0.02	13.07	Hilly	170,124	0.95	Hilly	76	0.95	Hilly	44,041	0.72	Hilly	45,327	0.24	Hilly		0.3	Hilly	44,958	0.95
SHL E	Shoreline Dr. S	0.00	13.90	Hilly		0.95	Hilly		0.95	Hilly	15,462	0.72	Hilly		0.24	Hilly		0.3	Hilly		0.95
SHL N	Shoreline Drive N	0.07	17.92	Hilly		0.95	Hilly	64,660	0.95	Hilly	150,420	0.72	Hilly	896,034	0.24	Hilly		0.3	Hilly	36,135	0.95
SPG, VIS	Spring Street	0.02	23.34	Hilly		0.95	Hilly	37,720	0.95	Hilly	31,519	0.72	Hilly	136,845	0.24	Hilly		0.3	Hilly	54,927	0.95
SPU	Spruce Street	0.01	17.91	Hilly		0.95	Hilly	134,323	0.95	Hilly	19,966	0.72	Hilly	8,590	0.24	Hilly		0.3	Hilly		0.95

Weighted Runoff Coefficients Continued

Stormwater System Basin	Location	Basin Area (sqmi)	Basin Average Slope (%)	Industrial, Heavy			Lawn			Single Family Residential			Suburban Residential			Undeveloped			Weighted C-values
				Description	Area	c	Description	Area	c	Description	Area	c	Description	Area	c	Description	Area	c	
ARP	Airport Avenue	0.02	20.37	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	92	0.48	Hilly	212,440	0.36	0.42
AIR NE	Airport NE	0.02	18.28	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly		0.48	Hilly	256,613	0.36	0.41
AIR NW	Airport NW	0.01	4.38	Rolling		0.8	Rolling		0.18	Rolling		0.48	Rolling		0.42	Rolling		0.24	0.62
AIR SE	Airport SE	0.06	36.11	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly		0.48	Hilly	465,108	0.36	0.35
AIR SW	Airport SW	0.00	2.60	Rolling		0.8	Rolling		0.18	Rolling		0.48	Rolling		0.42	Rolling		0.24	0.64
BST	B Street	0.00	29.56	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	46,817	0.48	Hilly		0.36	0.41
CST, AUG	C Street	0.07	20.95	Hilly	249,850	0.95	Hilly		0.24	Hilly		0.6	Hilly	232,541	0.48	Hilly	128,672	0.36	0.40
BYD	City Boat Yard	0.01	28.31	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	99,913	0.48	Hilly		0.36	0.61
DST, AUG	D Street	0.00	16.82	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	114,352	0.48	Hilly		0.36	0.51
ENG	English Drive	0.01	20.00	Hilly		0.95	Hilly	404	0.24	Hilly	19,534	0.6	Hilly	35,958	0.48	Hilly	57,593	0.36	0.53
FKR	Frank Raby Drive East	0.01	20.02	Hilly	207,127	0.95	Hilly		0.24	Hilly		0.6	Hilly		0.48	Hilly	3,592	0.36	0.87
FKR, RKY	Frank Raby Drive West	0.01	15.32	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	184,063	0.48	Hilly		0.36	0.47
FUL	Fulmore Avenue	0.01	8.73	Rolling		0.8	Rolling		0.18	Rolling	122,016	0.48	Rolling	14,090	0.42	Rolling		0.24	0.66
HBR	Haborview Drive	0.00	6.03	Rolling		0.8	Rolling		0.18	Rolling	48,541	0.48	Rolling		0.42	Rolling		0.24	0.60
ILI	Illiamna Street	0.00	20.78	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	26,332	0.48	Hilly		0.36	0.61
KAK	Kachemak Street	0.00	21.92	Hilly		0.95	Hilly		0.24	Hilly	38,668	0.6	Hilly	111	0.48	Hilly		0.36	0.62
LSU, BLC	Lake Street	0.02	10.77	Hilly		0.95	Hilly		0.24	Hilly	41,427	0.6	Hilly	352,416	0.48	Hilly	144,905	0.36	0.48
MNS	Main Street	0.00	14.14	Hilly		0.95	Hilly		0.24	Hilly	32,703	0.6	Hilly		0.48	Hilly	12,043	0.36	0.78
PEN	Peninsula Street	0.00	14.23	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	29,251	0.48	Hilly		0.36	0.77
ARP E	Seldovia Bridge E	0.00	21.74	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	6,073	0.48	Hilly		0.36	0.47
ARP W	Seldovia Bridge W	0.00	3.37	Rolling		0.8	Rolling		0.18	Rolling		0.48	Rolling		0.42	Rolling		0.24	0.95
SEL, ALD, LIP	Seldovia Street	0.02	13.07	Hilly		0.95	Hilly		0.24	Hilly	123,135	0.6	Hilly	94,007	0.48	Hilly	45,805	0.36	0.67
SHL E	Shoreline Dr. S	0.00	13.90	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	64,237	0.48	Hilly		0.36	0.53
SHL N	Shoreline Drive N	0.07	17.92	Hilly		0.95	Hilly	81,363	0.24	Hilly		0.6	Hilly	337,713	0.48	Hilly	279,779	0.36	0.38
SPG, VIS	Spring Street	0.02	23.34	Hilly		0.95	Hilly	9,582	0.24	Hilly		0.6	Hilly	186,200	0.48	Hilly	1,579	0.36	0.51
SPU	Spruce Street	0.01	17.91	Hilly		0.95	Hilly		0.24	Hilly		0.6	Hilly	25,961	0.48	Hilly		0.36	0.83

Note: All c-values are determined upon the assumption that the design storm for the City is the 50-year flood event. This increases the values found in the WSDOT, 2024 table to the right by 20%, which is accounted for in the above table. If the 20% increase made the c value larger than 0.95, it was kept at 0.95, per WSDOT instructions.

Stormwater System Basin	Location	Time of Concentration Methods														Velocity
		Basin Size	Run-off Coef.	Max Flow Length	Slope	Slope	FAA	FAA Equation	Kirpich	Kirpich	Kirpich Equation	Kerby	Kerby	Kerby Equation	Kirpich	
		A	C	L		S	G	TOC	G	k	TOC	G	r	TOC	Chosen TOC	
		acres	-	ft	deg	ft/ft	-	min	-	-		-	-	min	min	ft/min
ARP	Airport Avenue	13.57	0.42	1244.6	2.35	0.041	1.80	26.9	0.0078	1	6.4	0.827	0.6	38.3	6.4	193.2
AIR NE	Airport NE	10.51	0.41	1586.7	4.08	0.071	1.80	25.7	0.0078	1	6.3	0.827	0.6	37.7	6.3	252.6
AIR NW	Airport NW	6.44	0.62	1140.0	1.02	0.018	1.80	24.2	0.0078	1	8.3	0.827	0.6	44.6	8.3	137.3
AIR SE	Airport SE	37.92	0.35	3358.5	6.20	0.109	1.80	35.5	0.0078	1	9.5	0.827	0.6	48.5	9.5	353.0
AIR SW	Airport SW	2.64	0.64	701.2	0.61	0.011	1.80	21.6	0.0078	1	7.0	0.827	0.6	40.2	7.0	100.6
BST	B Street	1.56	0.41	451.4	5.58	0.098	1.80	12.4	0.0078	1	2.1	0.827	0.6	19.5	2.1	213.6
CST, AUG	C Street	43.16	0.40	2087.0	2.80	0.049	1.80	33.7	0.0078	1	9.0	0.827	0.6	46.8	9.0	232.7
BYD	City Boat Yard	5.99	0.61	1223.3	3.09	0.054	1.80	17.7	0.0078	1	5.7	0.827	0.6	35.6	5.7	213.8
DST, AUG	D Street	2.96	0.51	777.8	3.07	0.054	1.80	17.0	0.0078	1	4.0	0.827	0.6	28.9	4.0	192.1
ENG	English Drive	4.97	0.53	1181.5	1.96	0.034	1.80	23.5	0.0078	1	6.6	0.827	0.6	39.0	6.6	178.0
FKR	Frank Raby Drive East	5.87	0.87	981.8	2.06	0.036	1.80	8.6	0.0078	1	5.6	0.827	0.6	35.3	5.6	173.9
FKR, RKY	Frank Raby Drive West	5.76	0.47	1673.7	1.94	0.034	1.80	30.8	0.0078	1	8.7	0.827	0.6	46.0	8.7	192.2
FUL	Fulmore Avenue	5.47	0.66	857.3	1.29	0.023	1.80	17.6	0.0078	1	6.1	0.827	0.6	37.0	6.1	140.8
HBR	Haborview Drive	1.51	0.60	580.2	1.30	0.023	1.80	16.4	0.0078	1	4.5	0.827	0.6	30.8	4.5	129.2
ILI	Illiamna Street	2.04	0.61	764.7	1.74	0.030	1.80	16.9	0.0078	1	5.0	0.827	0.6	32.7	5.0	153.7
KAK	Kachemak Street	1.11	0.62	494.6	2.22	0.039	1.80	12.1	0.0078	1	3.2	0.827	0.6	25.2	3.2	152.8
LSU, BLC	Lake Street	14.61	0.48	1361.1	1.15	0.020	1.80	32.6	0.0078	1	9.1	0.827	0.6	47.1	9.1	149.9
MNS	Main Street	2.57	0.78	663.3	0.61	0.011	1.80	14.4	0.0078	1	6.7	0.827	0.6	39.2	6.7	99.1
PEN	Peninsula Street	1.73	0.77	544.9	1.64	0.029	1.80	9.9	0.0078	1	3.9	0.827	0.6	28.3	3.9	138.9
ARP E	Seldovia Bridge E	0.94	0.47	408.0	2.10	0.037	1.80	14.8	0.0078	1	2.8	0.827	0.6	23.3	2.8	143.2
ARP W	Seldovia Bridge W	0.07	0.95	194.9	1.47	0.026	1.80	2.8	0.0078	1	1.9	0.827	0.6	18.0	1.9	105.2
SEL, ALD, LIP	Seldovia Street	13.03	0.67	1417.4	1.63	0.028	1.80	20.4	0.0078	1	8.2	0.827	0.6	44.3	8.2	172.7
SHL E	Shoreline Dr. S	1.83	0.53	585.7	2.44	0.043	1.80	15.4	0.0078	1	3.6	0.827	0.6	26.7	3.6	164.7
SHL N	Shoreline Drive N	42.38	0.38	1962.7	2.49	0.044	1.80	35.2	0.0078	1	8.9	0.827	0.6	46.7	8.9	219.4
SPG, VIS	Spring Street	10.52	0.51	1558.0	3.11	0.054	1.80	23.7	0.0078	1	6.9	0.827	0.6	39.8	6.9	226.7
SPU	Spruce Street	4.34	0.83	895.1	2.65	0.046	1.80	8.8	0.0078	1	4.8	0.827	0.6	31.9	4.8	187.4

Stormwater System Basin	Location	i, Rainfall Intensity (inches/hour)							
		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
Basin	Basin ID	inches/hour							
ARP	Airport Avenue	1.14	1.45	1.70	2.05	2.34	2.60	2.97	3.44
AIR NE	Airport NE	1.15	1.46	1.72	2.08	2.36	2.63	3.00	3.48
AIR NW	Airport NW	0.99	1.25	1.48	1.77	2.02	2.25	2.57	2.98
AIR SE	Airport SE	0.89	1.12	1.33	1.59	1.81	2.02	2.30	2.68
AIR SW	Airport SW	1.10	1.39	1.64	1.97	2.24	2.50	2.85	3.31
BST	B Street	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
CST, AUG	C Street	0.93	1.18	1.40	1.67	1.91	2.12	2.42	2.82
BYD	City Boat Yard	1.20	1.52	1.79	2.16	2.46	2.73	3.12	3.62
DST, AUG	D Street	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
ENG	English Drive	1.12	1.43	1.68	2.02	2.30	2.56	2.93	3.39
FKR	Frank Raby Drive East	1.21	1.53	1.80	2.17	2.47	2.75	3.14	3.64
FKR, RKY	Frank Raby Drive West	0.95	1.21	1.43	1.71	1.95	2.17	2.48	2.88
FUL	Fulmore Avenue	1.17	1.48	1.75	2.11	2.39	2.66	3.04	3.53
HBR	Haborview Drive	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
ILI	Illiamna Street	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
KAK	Kachemak Street	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
LSU, BLC	Lake Street	0.92	1.17	1.38	1.66	1.89	2.10	2.40	2.79
MNS	Main Street	1.12	1.42	1.67	2.02	2.29	2.55	2.91	3.38
PEN	Peninsula Street	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
ARP E	Seldovia Bridge E	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
ARP W	Seldovia Bridge W	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
SEL, ALD, LIP	Seldovia Street	0.99	1.26	1.49	1.79	2.03	2.27	2.59	3.00
SHL E	Shoreline Dr. S	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80
SHL N	Shoreline Drive N	0.93	1.18	1.40	1.68	1.91	2.13	2.43	2.82
SPG, VIS	Spring Street	1.10	1.40	1.65	1.99	2.26	2.52	2.88	3.34
SPU	Spruce Street	1.26	1.60	1.88	2.27	2.58	2.87	3.28	3.80

Note: The Rational Method uses a minimum 5 minute time of concentration when interpolating rainfall intensity for a given drainage basin. In the case that a basin's time of concentration falls below 5 minutes, the 5 minute duration precipitation intensity provided by NOAA Atlas 14 will be used as the estimate for that basin across all durations.

Duration (min)	NOAA Atlas 14 Point Precipitation Estimates (inches/hour)							
	Average Recurrence Interval (years)							
	2	5	10	25	50	100	200	500
5	1.26	1.6	1.88	2.27	2.58	2.87	3.28	3.8
10	0.846	1.07	1.27	1.52	1.73	1.93	2.2	2.56
15	0.66	0.84	0.988	1.19	1.35	1.5	1.71	1.99
30	0.438	0.556	0.656	0.79	0.894	0.998	1.14	1.32
60	0.3	0.381	0.449	0.541	0.613	0.684	0.779	0.906
120	0.24	0.305	0.36	0.434	0.49	0.547	0.624	0.724

Stormwater System Basin	Location	Rational Method Flow Estimates (cfs)							
		2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	200-Year	500-Year
ARP	Airport Avenue	6.5	8.3	9.7	11.7	13.3	14.9	17.0	19.7
AIR NE	Airport NE	5.0	6.3	7.4	9.0	10.2	11.4	13.0	15.0
AIR NW	Airport NW	3.9	5.0	5.9	7.1	8.0	8.9	10.2	11.8
AIR SE	Airport SE	11.7	14.8	17.5	21.0	23.9	26.6	30.3	35.3
AIR SW	Airport SW	1.8	2.3	2.8	3.3	3.8	4.2	4.8	5.6
BST	B Street	0.8	1.0	1.2	1.4	1.6	1.8	2.1	2.4
CST, AUG	C Street	16.3	20.6	24.4	29.2	33.2	37.1	42.3	49.1
BYD	City Boat Yard	4.4	5.5	6.5	7.9	8.9	9.9	11.4	13.2
DST, AUG	D Street	1.9	2.4	2.8	3.4	3.9	4.3	4.9	5.7
ENG	English Drive	3.0	3.7	4.4	5.3	6.0	6.7	7.7	8.9
FKR	Frank Raby Drive East	6.1	7.8	9.1	11.0	12.5	14.0	15.9	18.5
FKR, RKY	Frank Raby Drive West	2.6	3.3	3.9	4.6	5.3	5.9	6.7	7.8
FUL	Fulmore Avenue	4.2	5.4	6.3	7.6	8.7	9.6	11.0	12.8
HBR	Haborview Drive	1.1	1.5	1.7	2.1	2.3	2.6	3.0	3.5
ILI	Illiamna Street	1.6	2.0	2.3	2.8	3.2	3.6	4.1	4.7
KAK	Kachemak Street	0.9	1.1	1.3	1.6	1.8	2.0	2.3	2.6
LSU, BLC	Lake Street	6.5	8.2	9.7	11.6	13.2	14.7	16.8	19.5
MNS	Main Street	2.3	2.9	3.4	4.1	4.6	5.2	5.9	6.8
PEN	Peninsula Street	1.7	2.1	2.5	3.0	3.4	3.8	4.3	5.0
ARP E	Seldovia Bridge E	0.6	0.7	0.8	1.0	1.1	1.3	1.5	1.7
ARP W	Seldovia Bridge W	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
SEL, ALD, LIP	Seldovia Street	8.7	11.1	13.1	15.7	17.9	19.9	22.7	26.4
SHL E	Shoreline Dr. S	1.2	1.5	1.8	2.2	2.5	2.8	3.2	3.7
SHL N	Shoreline Drive N	15.0	19.0	22.5	27.0	30.7	34.3	39.1	45.4
SPG, VIS	Spring Street	6.0	7.6	8.9	10.8	12.2	13.6	15.6	18.1
SPU	Spruce Street	4.5	5.7	6.8	8.2	9.3	10.3	11.8	13.7

Equations for Time of Concentration
The following equations are used for the calculation. All of the equations shown below use the English units indicated in the Variables section. Of course, our calculation uses a variety of units with all of the unit conversions handled internally by the program. The equations can be found in Chin (2000), Chow et al. (1988), Corbitt (1999), and Singh (1992).

FAA equation: $t = G (1.1 - c) L^{0.5} / (100 S)^{1/3}$

Kirpich equation: $t = G k (L / S^{0.5})^{0.77}$

Kerby equation: $t = G (L r / S^{0.5})^{0.467}$

Recommendations
The FAA method was developed from data obtained from airport runoff but has been successfully applied to overland flow in urban areas. The Kirpich equation was developed from data obtained in seven rural watersheds in Tennessee (USA). The watersheds had well-defined channels and steep slopes of 0.03 to 0.1 ft/ft (3 to 10%) and areas of 1 to 112 acres. It is used widely in urban areas for both overland flow and channel flow; and it is used for agricultural watersheds up to 200 acres (80 hectares). The Kerby equation was developed from data obtained in watersheds having watercourses less than 1200 ft. (365 m), slopes less than 0.01 ft/ft (1%), and areas less than 10 acres (4 hectares).

Variables for Time of Concentration
The units refer to the units that must be used in the equations shown above. However, a variety of units may be used in our calculation.

c = [Rational method](#) runoff coefficient. See table below.
G = Constant. FAA: G=1.8, Kirpich: G=0.0078, Kerby: G=0.8268
k = Kirpich adjustment factor. See table below.
L = Longest watercourse length in the watershed, ft.
r = Kerby retardance roughness coefficient. See table below.
S = Average slope of the watercourse, ft/ft or m/m.
t = Time of concentration, minutes.
V = Average velocity in watercourse, ft/min. V=L/t.

The coefficients in Table 2-2 are applicable for peak storms of 10-year frequency. Less frequent, higher-intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. Generally, when designing for a 25-year frequency, the coefficient shall be increased by 10 percent; when designing for a 50-year frequency, the coefficient shall be increased by 20 percent; and when designing for a 100-year frequency, the coefficient shall be increased by 25 percent. The runoff coefficient shall not be increased above 0.95, unless approved by the RHE. Higher values may be appropriate for steeply sloped areas and/or longer return periods, because in these cases infiltration and other losses have a proportionally smaller effect on runoff.

Table 2-2 Runoff Coefficients for the Rational Method: 10-Year Return Frequency

Cover Type	Flat	Rolling (2%-10%)	Hilly (Over 10%)
Pavement and roofs	0.90	0.90	0.90
Earth shoulders	0.50	0.50	0.50
Drives and walks	0.75	0.80	0.85
Gravel pavement	0.50	0.55	0.60
City business areas	0.80	0.85	0.85
Suburban residential	0.25	0.35	0.40
Single-family residential	0.30	0.40	0.50
Multi units, detached	0.40	0.50	0.60
Multi units, attached	0.60	0.65	0.70
Lawns, very sandy soil	0.05	0.07	0.10
Lawns, sandy soil	0.10	0.15	0.20
Lawns, heavy soil	0.17	0.22	0.35
Grass shoulders	0.25	0.25	0.25
Side slopes, earth	0.60	0.60	0.60
Side slopes, turf	0.30	0.30	0.30
Median areas, turf	0.25	0.30	0.30
Cultivated land, clay, and loam	0.50	0.55	0.60
Cultivated land, sand, and gravel	0.25	0.30	0.35
Industrial areas, light	0.50	0.70	0.80
Industrial areas, heavy	0.60	0.80	0.90
Parks and cemeteries	0.10	0.15	0.25
Playgrounds	0.20	0.25	0.30
Woodland and forests	0.10	0.15	0.20
Meadows and pasture land	0.25	0.30	0.35
Pasture with frozen ground	0.40	0.45	0.50
Unimproved areas	0.10	0.20	0.30

Table 3-2. Rational formula coefficients for various HSGs

HYDROLOGIC SOIL GROUP														
		A soil			B soil			C soil			D soil			
Slope		0-2%	2-6%	+6%	0-2%	2-6%	+6%	0-2%	2-6%	+6%	0-2%	2-6%	+6%	
Landcover														
Forest, brush		a*	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
		b*	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Wetland		a							0.12	0.16	0.20	0.12	0.16	0.20
Parkland		a	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
		b	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Cultivated		a	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
		b	0.08	0.14	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture		a	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
		b	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Lawn		a	0.17	0.22	0.35	0.17	0.22	0.35	0.17	0.22	0.35	0.17	0.22	0.35
Barren		a	0.25	0.30	0.35	0.25	0.30	0.35	0.50	0.55	0.60	0.50	0.55	0.60
Graded slope														
Gravel		a	0.25	0.30	0.35	0.25	0.30	0.35	0.50	0.55	0.60	0.50	0.55	0.60
Earthen		a	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Drives, walks		a	0.75	0.80	0.85	0.75	0.80	0.85	0.75	0.80	0.85	0.75	0.80	0.85
Streets														
Gravel		a	0.50	0.55	0.60	0.50	0.55	0.60	0.50	0.55	0.60	0.50	0.55	0.60
Paved		a	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
		b	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97
Impervious		a	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
		b	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

* - a, ≤ 25-year, 24-hour event; b, >25-year, 24-hour event
Modified from: Rawls et al. 1981; WSDOT 2005.

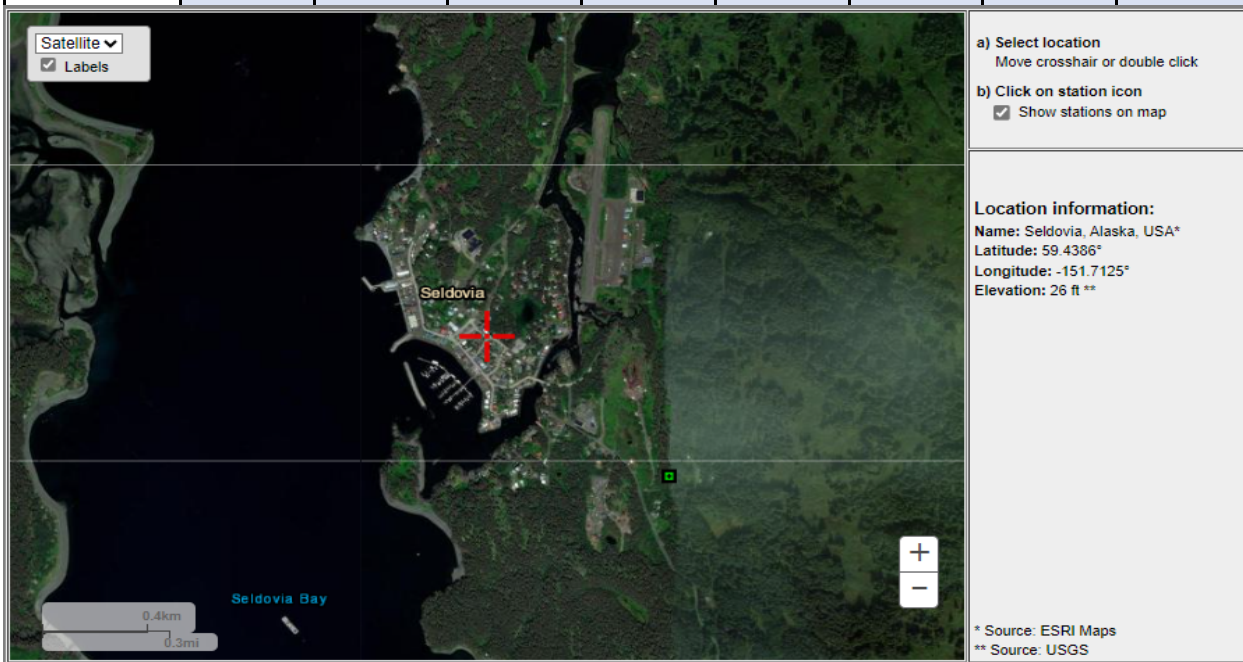
NOAA Atlas 14 Point Precipitation EstimatesData Type: **Precipitation Intensity**

Units: English

Time Series: Partial Duration

Precipitation Intensity (inches/hour)

Duration	Average Recurrence Interval (years)							
	2	5	10	25	50	100	200	500
5-min	1.260	1.600	1.880	2.270	2.580	2.870	3.280	3.800
10-min	0.846	1.070	1.270	1.520	1.730	1.930	2.200	2.560
15-min	0.660	0.840	0.988	1.190	1.350	1.500	1.710	1.990
30-min	0.438	0.556	0.656	0.790	0.894	0.998	1.140	1.320
60-min	0.300	0.381	0.449	0.541	0.613	0.684	0.779	0.906
2-hr	0.240	0.305	0.360	0.434	0.490	0.547	0.624	0.724
3-hr	0.219	0.279	0.328	0.396	0.448	0.499	0.568	0.661
6-hr	0.184	0.234	0.275	0.332	0.376	0.420	0.478	0.556
12-hr	0.143	0.180	0.211	0.254	0.289	0.325	0.370	0.429
24-hr	0.104	0.131	0.152	0.184	0.210	0.237	0.271	0.314



Source:

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_ak.html



Appendix C – Final Drainage Field Inspection Memo



Memo

Date: Wednesday, May 01, 2024

Project: City of Seldovia | Drainage Map and Stormwater Management Plan

To: Heidi Geagel and Jan Yaeger; City of Seldovia

From: Bill Spencer, PE; Irene Turletes, PE; and Kacy Grundhauser, EIT; HDR

Subject: FINAL Drainage Field Inspection Memo

Introduction and Objectives

The City of Seldovia (City) is a small community located on the south shore of Kachemak Bay, within the Kenai Peninsula Borough (KPB). City limits encompass 0.4 square mile of land, 0.2 square mile of water, with approximately 7.5 miles of State- and City-maintained roads (approximately 6 miles are unpaved). Seldovia Bay is the major waterbody that surrounds the City and is connected to Kachemak Bay to the north. The City is accessible by aircraft via a State-owned airfield or boat from Homer. There is an extensive road system south and east of the city that provides access to outlying areas.

In 2023, the City received an Alaska Clean Water Action grant from the Alaska Department of Environmental Conservation (ADEC) to create drainage mapping of the community, identify types and quantities of nonpoint source pollution, develop a stormwater management plan, and provide recommendations for treatment of stormwater before it enters local streams and other waterbodies. The goal of this project is to provide infrastructure improvements, water quality enhancements, and habitat protection recommendations within the city limits, as shown in Figure 1 for existing and future development around Seldovia Bay.

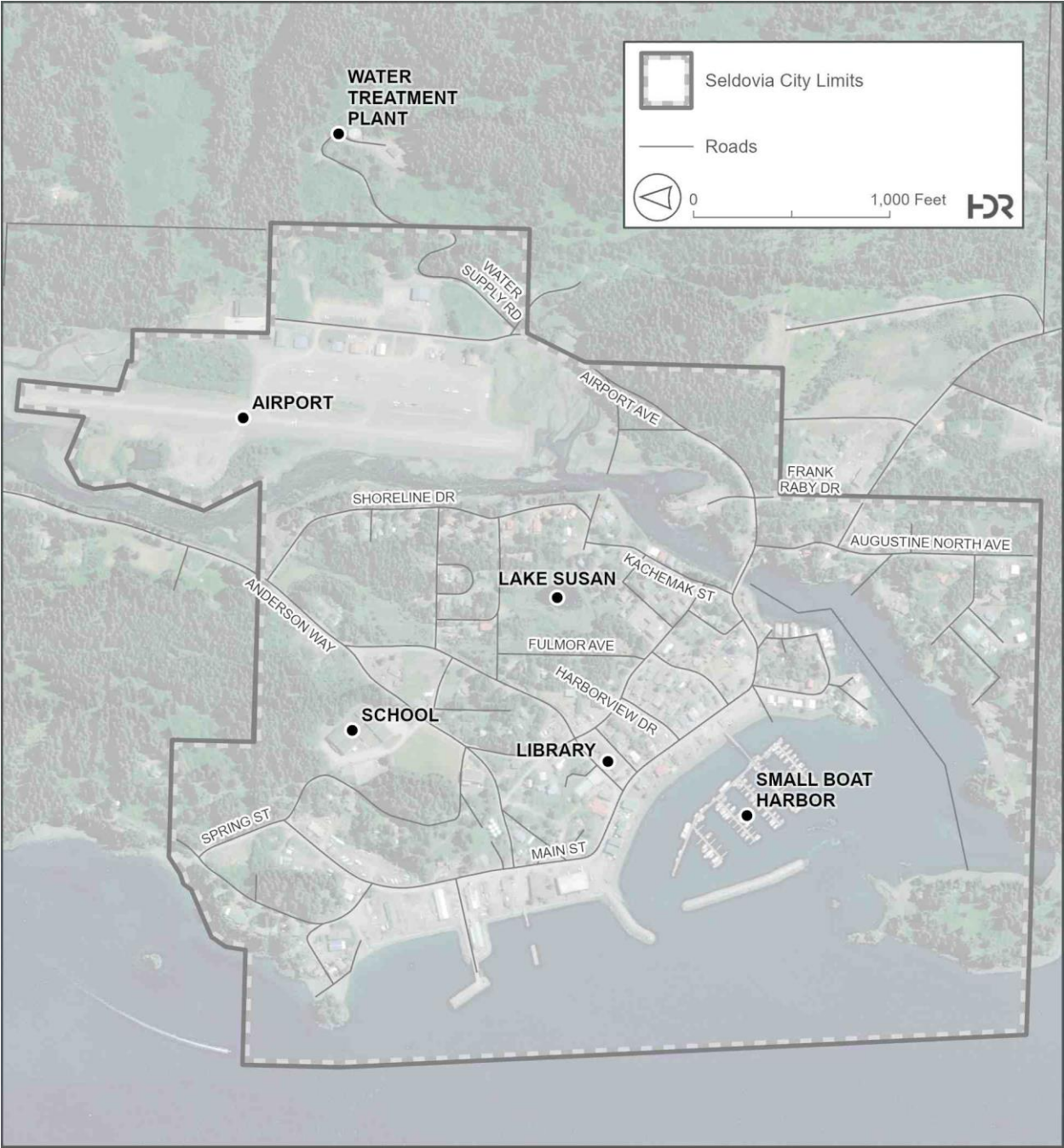


Figure 1. Seldovia Overview Map

Imagery Source: USACE 2019

HDR Engineering, Inc. (HDR), has been contracted to assist the City in developing the grant’s action items. This field inspection memo is the first deliverable on the project and discusses the topics listed below. Commonly used acronyms and abbreviations are provided in Appendix A.

Contents

Existing Drainage Infrastructure Research.....	3
Community Input.....	3



Field Inspection Overview.....5

Drainage System Descriptions8

Hydrologic Analysis.....25

 Precipitation25

 Flood Flow Analyses.....25

Preliminary Recommendations29

References31

Appendices

- Appendix A – Acronyms and Abbreviations
- Appendix B – Community Involvement Documents
- Appendix C – City-Provided Maps
- Appendix D – HDR Field Inspection Notes
- Appendix E – Drainage Maps
- Appendix F – Supplemental Calculations

Existing Drainage Infrastructure Research

A desktop analysis of the Seldovia drainage system was conducted and compiled into a geographic information system (GIS) data structure with the assistance of the City Manager and City Public Works Operators. The City’s as-built drawings for drainage and road improvements projects date from after the 1964 earthquake (1969 Urban Renewal project) up through the 1990s, with the majority of documents available in hardcopy form. Available digital as-builts were reviewed before the field inspection visit, and the physical as-builts were compiled during and after the visit.

Seldovia’s drainage system was replaced by the 1969 Urban Renewal project, with additional roadway and drainage improvement projects occurring between 1983 to 1993. Paving of downtown streets and piped drainage occurred mostly as a part of the Urban Renewal project. The typical life span of the galvanized steel pipes used during initial construction is around 75 years; shorter life spans are common, especially in coastal environments.

Community Input

An online drainage and stormwater survey was conducted in the local community from August 21 through September 29, 2023. The local community was informed of the survey through a postcard mailer sent to 225 local addresses, social media posts through City accounts, physical postings, and word of mouth. In addition to the online survey, a project email and phone number was provided to collect input and answer questions.

The survey included the following 10 questions to help identify drainage and stormwater issues in Seldovia:



1. Has a roadway near your property ever flooded due to rain?
2. Are there culverts in your area that appear to be unmaintained, undersized, or failing?
3. Does water continue to stand in roadside ditches, roadways, or other channels more than two days after a rain ends?
4. Has your property or the roadway to your property been threatened by eroding creek banks or ditches?
5. Do you have any concerns with where snow is stored in the winter?
6. Do you have any issues with spring drainage from snow storage?
7. In the last five years has the water quality of stormwater runoff gotten worse?
8. Are there other drainage issues, within the city limits, that you would like the city to be aware of?
9. Do you think there are any projects or programs that would help improve the stormwater system for the city?
10. Do you have any other stormwater or drainage concerns that you wish to share?

Thirteen community members responded to the survey or provided their input, which aggregated to 42 points of interest. The responses from the survey (provided in Appendix B) were analyzed and used as points of focus during the field inspection.

In addition to the public, the City identified the following organizations and entities as project stakeholders:

- Alaska Department of Transportation and Public Facilities (DOT&PF) – Central Region
- City Council of Seldovia
- City Public Works Operators
- KPB
- Seldovia Village Tribe (SVT)

On September 25, 2023, an in-person and a virtual, 1-hour Drainage Working Session were hosted by the City and attended by the City Council, two members of the public, and HDR's field inspection team to discuss project objectives, proposed schedule, and anticipated outcomes.

City Public Works Operators joined the HDR field inspection for 2 days, and the discussions that resulted are documented below in the *Field Inspection* section.

On November 7, 2023, a virtual, 1-hour stakeholder meeting was hosted by HDR and attended by SVT, the City, and HDR. SVT is a sovereign, self-governing entity that promotes the wellness of their people and community through healthcare and social services, economic development and education. Several facilities throughout the city are owned and maintained by SVT. This meeting's purpose was to provide an overview of the project, discuss any drainage issues and concerns identified by SVT, and to summarize the project's efforts to date.

On December 15, 2023, a virtual, 1-hour stakeholder meeting was hosted by HDR and attended by DOT&PF, the City, and HDR. DOT&PF owns and maintains Seldovia Airport, a public-use gravel airstrip located within City limits. They are also responsible for maintaining Airport Avenue, Anderson Way, and Dock, Main, and Seldovia streets. The purpose of this meeting was to provide an overview of the project, discuss any drainage issues and concerns identified by the Seldovia-based DOT&PF Operator, and coordinate efforts on proposed stormwater projects.



The City requested to postpone engagement with KPB until future phases of this project.

From the SVT and DOT&PF stakeholder meetings, 13 points of interest were determined. DOT&PF commented that the catch basins and manholes were last cleaned out around 2015 and pavement crack sealing had occurred in 2023. Stakeholder meeting minutes are provided in Appendix B.

Field Inspection Overview

From September 25 through 29, 2023, HDR Professional Engineer (PE) Bill Spencer and Engineer-in-Training (EIT) Kacy Grundhauser visited Seldovia to conduct a field inspection of the existing drainage system. The purpose of this field inspection was to:

- Inspect and document the existing drainage infrastructure within City limits.
- Photo document the existing visible parts of the system. (No closed-circuit television was used.)
- Review State- and City-maintained roads and ditch lines as they relate to overall drainage.
- Inspect and document locations of potential and suspected water quality concerns.
- Investigate key locations of concern mentioned in drainage survey responses.
- Discuss drainage issues and concerns with City Public Works personnel.
- Field questions, concerns, and comments from local residents about the project, drainage infrastructure, and stormwater.

Weather during the field inspection consisted of temperatures typically in the mid-40s (degrees Fahrenheit [°F]) during the day, with a high of 50°F and a low of 39°F. The weather was cloudy to sunny with little to no precipitation accumulation during the site visit or the week prior. Unfortunately, no surface precipitation runoff was in progress during the field visit.

HDR field investigation equipment consisted of an Apple iPad Pro with the Field Maps application to collect georeferenced field data, a field notebook and hard copy maps for handwritten notes and sketches, a measuring tape, a folding ruler, a high-powered light, a metal detector, a shovel, and a pickaxe to open manholes. Detailed investigations were accomplished on foot.

A narrative of the work schedule and areas of inspection is provided chronologically below.

September 25

Bill and Kacy arrived in Seldovia around 2:00 pm. City Manager Heidi Geagel picked them up from the airport and dropped them off at their lodging. At 4:30 pm, Bill and Kacy attended the 1-hour, in-person Drainage Working Session (a virtual option was available for residents), located in the Council Chambers. Bill and Kacy introduced themselves and the project on behalf of HDR. The City Council, community members, and HDR discussed snow removal, road maintenance (grading, dust suppression chemicals [calcium chloride] used in the past by DOT&PF, sand use for traction control used by the City and DOT&PF), infiltration of groundwater in the sanitary sewer system, drinking water system infrastructure, corroding water lines on Vista Avenue, and how these topics affect the water quality of the runoff into Seldovia Slough, the small boat harbor, and Kachemak Bay. After the meeting was adjourned, members of the City Council and HDR informally discussed drainage areas of concern over a large plat map. Concerns discussed during the Working Session meeting and during the plat map discussion were recorded and marked for investigation during field inspections.



Bill and Kacy used the rest of the evening to walk the northern part of town and part of the Otterbahn Trail.

September 26

At 8:30 am, Bill and Kacy met Heidi at the City Office. Heidi discussed how the 1964 Alaska Earthquake impacted Seldovia, and from the mid-1960s to the early 1970s, how the Alaska State Housing Authority's Urban Renewal Program made stormwater improvements, among many other utility, road, building, and boardwalk modifications. Heidi, Bill, and Kacy loaded into a vehicle to tour the City's drainage infrastructure. Heidi first showed the ponding water issues and snow storage in the parking lot adjacent to the Seldovia Liquor Store (275 Main Street). Heidi mentioned that the City stores snow wherever possible (the City's snow removal map is provided in Appendix C). The group stopped by Fulmor Avenue, and Heidi mentioned that SVT and Seldovia Native Association, Inc., has ongoing construction at 240 Fulmor Avenue where the contractor hit a stormwater pipe within the parcel. The group then stopped by the Historic Boardwalk and discussed drainage concerns where the boardwalk and Bay Street meet.

Around 9:00 am, City Public Works Operator John Gruber took over showing Bill and Kacy areas of drainage concerns. The group stopped at Frank Raby Drive, C Street, Kachemak Street, Water Supply Road, the old dam off of Jackson Drive, Shoreline Drive, Young Street, the Lake Susan outlet along Lake and Kachemak streets, the City boat yards, Spring Street, and Spruce Street to view and discuss additional drainage concerns noted during maintenance work. Concerns discussed with the City were recorded and marked for HDR to investigate further over the following days.

Around 10:30 am, the group returned to the City Office. City Public Works loaned HDR a metal detector, shovel, and pickaxe to use during HDR's field inspections. From 10:30 am to 12:00 pm, City Financial Officer Jan Yaeger assisted the HDR team in accessing the City's Archives in search of as-builts and records related to drainage infrastructure installation and improvements. A storm and sanitary sewer improvements map from the 1969 *Alaska State Housing Authority's Seldovia Urban Renewal Project R-26* (City 1969) was found; however, little additional relevant information was located during this effort.

Bill and Kacy then incorporated the additional stormwater infrastructure from the 1969 Urban Renewal Project into the ArcGIS Field Maps mapping application HDR was using to visualize and collect georeferenced field data.

Just after 1:00 pm, the HDR team started their more in-depth field investigations of the City's stormwater infrastructure, beginning along the northern portion of Main Street, along Iliamna, Inlet, Spruce, and Spring streets, and Vista Avenue. The Iliamna Street outfall was not located in the breakwater rock. Residents on Vista Avenue were interviewed about its drainage. The team noted that Vista Avenue terminates at the top of the hill and, though platted, does not connect to Winifred Avenue.

The team then returned to Main Street to assess general drainage and piped systems from Spring Street to English Street. Topography around the City boat yards was relatively flat. Near Eternal Buzz Espresso (346 Iliamna Street), Main Street transitioned from gravel to pavement. Generally, the commercial and industrial buildings located along the west side of Main Street drained toward Seldovia Bay and the City Harbor, especially along Dock Street. Extensive coastal protection rock has been placed along this stretch of coastline. The team then investigated the stormwater



infrastructure along English Street, Winifred Avenue, Young Street, and Anderson Way (to the Shoreline Drive intersection). Along this stretch, there were several ditches that convey flow. Around 8:00 pm, the team returned to lodging for the evening.

September 27

At approximately 9:30 am, Bill and Kacy continued their investigation along Main Street, from Barnes Street to Seldovia Street. They also investigated Church Street, noting that the location of the street is different than how it is shown on the KPB platting. Once the team reached Main Street's intersection with Seldovia Street, they investigated the system starting at Alder Street and Winifred Avenue. The team also investigated other branches of the system along Alder Street and Lipke Lane before following the main pipe system down Seldovia Street.

Continuing down Main Street, the team assessed the area from Seldovia Street to Peninsula Street. They investigated separate stormwater systems along Harborview Drive, Fulmor Avenue, and Peninsula Street, all which drain to the southwest and outfall into the harbor. At Fulmor Avenue, Alder Street transitions from pavement to dirt and gravel. Along Main Street, Bill and Kacy saw several cases of rutted parking lots, sediment buildup in curb lines, and poor outfall pipe conditions. The Peninsula Street outfall was not located in the breakwater rock. While investigating the piped stormwater systems, they noted surface drainage along the rest of Alder Street, Cedar Street, and Willow Street. The KPB platting for Cedar Street did not appear to extend to the end of the street.

Then the team assessed the drainage along the last portion of Main Street and Bay Street. Airport Avenue, from Peninsula Street to Augustine North Avenue, was also assessed before the team returned to lodging for the evening around 8:30 pm.

September 28

In the morning, HDR scheduled a meeting with City Public Works Operator Jordan Cameron. Due to scheduling conflicts, the meeting was rescheduled to the following day, and HDR continued with the field inventory. Around 10:00 am, the HDR team spoke with a Bay Street resident and scheduled a meeting with them later in the day to further investigate drainage patterns along Bay Street.

From 11:00 am to 4:30 pm, Bill and Kacy assessed Anderson Way from Seldovia Street to Shoreline Drive, also assessing Service Lane along the way. The team then turned onto Shoreline Drive and assessed stormwater infrastructure down Shoreline Drive, assessing the following streets along the way: Malcom, Young, Eagle Run Loop, Spillum, and Bloch. Eagle Run Loop consists of two curved streets and does not fully connect as the KPB platting indicates. The gravel portion of Bloch Street that is drivable ends at Spillum Street. Otherwise, the KPB platting shows where a walking trail through the marsh exists for parts of Bloch Street and Fulmor Avenue. Assessments continued along Lake and Kachemak streets, which contain the outlet infrastructure for Lake Susan. A resident on Lake Street was familiar with Lake Susan, its water level, and its drainage infrastructure. The team noted limited right-of-way along Kachemak Street, constraining drainage and winter maintenance. Drainage was reviewed along Cedar, Willow, and a portion of Alder streets and Lindstedt Lane.

From 4:30 pm to 5:10 pm, the HDR team headed to Bay Street to reconvene with the resident they had met earlier that day. The group discussed drainage patterns, impervious surfaces, the Bin-Wall retaining wall, pilings, the Historic Boardwalk, and drainage improvement ideas. While in the area, HDR also met and spoke with another resident of Bay Street.



From 5:10 pm to 8:30 pm, the HDR team examined drainage patterns and infrastructure along Airport Avenue from Augustine North Avenue through the Seldovia Airport. Drainage along Frank Raby Drive was also investigated. The team noted limited right-of-way along Frank Raby Drive, constraining drainage. The 108-inch Fish Creek culvert was briefly investigated, and the numerous Airport cross culverts were inventoried. The team drove the East Addition to get an idea of the general drainage layout before returning to lodging for the evening around 8:30 pm.

September 29

In the morning, the HDR team organized field notes and entered new field data into the Field Maps application. From 9:40 am to 11:00 am, the HDR team talked with both City Public Works Operators, John and Jordan, about drainage system questions that had arisen from the inventory efforts and areas of drainage concern from residents.

Starting around 11:00 am, Bill and Kacy inventoried the East Addition with Jordan. The group assessed Augustine North Avenue, D Street, Chrissy Avenue, A Street, C Street, Willards Way, and B Street and discussed drainage along Frank Raby Drive. They noted that A Street is not fully developed, unlike what is shown in the KPB platting. The HDR team took a final look at drainage along Winifred Avenue before wrapping up field investigations by 2:00 pm.

Around 2:00 pm, HDR returned to lodging to pack up. At 3:00 pm, Bill and Kacy returned the borrowed City Public Works tools. They discussed their initial impressions with Heidi and reviewed additional plan sets the City had available at the City Office. Around 3:30 pm, Bill and Kacy were dropped off at the airport and departed from Seldovia.

Handwritten field notes from field inspections are provided in Appendix D. The field notes recorded in the Field Maps application were used to assist in development of the drainage maps (Appendix E).

Drainage System Descriptions

The drainage systems within City limits were investigated and grouped based on the road and/or area they drained. A total of 28 drainage systems are defined and described below in the order they appear in Appendix E – Drainage Maps.

Naming conventions consist of three letters, followed by one letter, followed by three numbers, such as: XXX-P/S-0###. The first three letters correspond to the system's abbreviated name; the single letter is either a P for pipe or culvert, or an S for structure; and the three numbers correspond to the sequential number in the system. Abbreviated system names are provided in parentheses in the section titles and in Appendix A. P indicates pipes, which are pipes connected to a drainage system and culverts, which are open-ended pipes that provide cross drainage. S indicates catch basins, manholes, and outlets. In this context, an outlet refers to the open end of a pipe at the terminus of a drainage system. Drainage infrastructure with a name that ends with an asterisk (*) indicates that a portion or all of the feature was not located during field inspections. In these cases, available record drawings were used to supplement field inspections.

Appendix E also provides visualization of other drainage features including surface flow direction arrows, open channels (ditches and curblines), and drainage basins. Surface flow direction arrows provide the general direction of flow; open channels define maintained drainage ditches; and

drainage basins provide the drainage extents for each outlet. Select photos are provided in the following sections to supplement the system descriptions. A Google Earth compatible .KMZ file of drainage features with additional information and site visit photos is provided with this memo.

Spring (SPR) and Spruce (SPU) Streets

Spring and Spruce streets are located in the northwest corner of City limits and provide drainage for Vista Avenue, the City boat yards, and some residences along Spruce Street. The terminus of these systems consists of two culverts (SPG-P-001 and SPU-P-001) that outfall onto Inside Beach. City Public Works noted that the southern detention basin at the intersection of Spruce and Spring Streets often ponds and that the ditch along Spring Street is in bedrock. The inlet of SPU-P-001 was dug out during field inspections.



SPR-P-001 Inlet

SPG-P-001 Outlet

Figure 2. Select Photos – SPR and SPU

Vista Avenue (VIS)

Vista Avenue basin drains the northwest side of the school yard and several residential lots. During the inspection, there was a concentration of surface and potentially groundwater that flowed just north of 349 Vista Avenue. A ditch and approximately 4-inch-diameter plastic pipe (VIS-P-001) between houses directs flow downhill towards the City boat yards. At the intersection of Vista Avenue and Main Street, VIS-P-003 drains stormwater towards Spring Street (SPG). VIS-P-003 has a smashed inlet and minimal cover. There is a road that branches off Vista Avenue and heads north. VIS-P-002 drains this road slightly uphill of where the roads intersect.

The water exiting VIS-P-001 contains a large amount of orange flocculant, which could indicate iron-rich ground water. The HDR team spoke with several local residents about drainage along Vista Avenue. Additionally, the City mentioned that they are actively replacing corroded water lines in this area, which is an issue not experienced in other areas of the town.

While Vista Avenue does not connect, a separate section continues south of the school's yard. This segment drains towards a drainage ditch that runs along the front of the school's yard, uphill (west) of Winifred Avenue. No major drainage concerns were noted.



VIS-P-003 Inlet

VIS-P-001 Outlet

Figure 3. Select Photos – VIS

Illiamna Street (ILI)

There is minimal piped drainage infrastructure along Illiamna Street, as most of the stormwater surface flows directly into Seldovia Bay or drains poorly along Inlet Street. A short piped system (ILI) drains the southern-facing portion of Spruce Street and Illiamna Street and contains one field inlet (ILI-S-001) and one manhole (ILI-S-002). The outlet (ILI-S-003*) was not located in the coastal rock but is assumed to be near the City boat launch. The grade of the road and gravel parking lot is relatively flat and likely contributes to the poor drainage. Stormwater ponding was evident near the City boat launch and along Inlet Street. Stormwater on Inlet Street is generally surface drainage between residences, mostly to the south.

City Boat Yard (BYD)

The City boat yards are located at the northern end of Main Street and drain to the northeast (VIS) and to the southwest (BYD). The southern part of the boat yard is assumed to accumulate flow from the hillside and VIS-P-001. Main Street and the gravel boat yards are relatively flat throughout the area. Main Street also transitions from gravel to pavement in front of Eternal Buzz Espresso (346 Illiamna Street). BYD-S-001 and BYD-S-002 have sediment buildup around the curb inlets and in the pipe network. Sediment accumulations are common across the whole drainage system. The outlet (BYD-S-003) is in fair shape with some sediment buildup. No major water quality concerns from the City boat yards were identified from field investigations and community discussions.



BYD-S-002

BYD-S-003 Outlet

Figure 4. Select Photos – BYD

English Drive (ENG)

The ENG system spans English Drive and Kenai Street. Some parts of this system were not located during the field inspection, so record drawings were used to supplement. A 1993 *Drainage Improvement* plan set by William J. Nelson & Associates details an 8-inch-diameter drain pipe and associated stormwater infrastructure (ENG-P-002* through ENG-P-003*) between residences at 270 and 284 English Drive (City 1993). This area was checked during field inspections, but the infrastructure was not located. A 2010 *Water and Sewer Improvements* record drawing, developed by CRW Engineering Group, LLC, with the ADEC Village Safe Water Program, shows ENG-S-002 through ENG-S-005*. The outlet (ENG-S-006) was located during field investigations, and based on its general direction, seems to indicate that it connects to stormwater infrastructure along Kenai Street. The HDR team discussed this system with City Public Works. This system was mapped using available resources and information gathered during the field inspection, but it should be field located if improvement projects are planned.

There is an active ADEC contaminated site located north of the intersection of English Drive, Church Street, and Alder Street located within the ENG system's drainage basin. The "Seldovia Tank Farm" contaminated site has a record of diesel contamination found below the tank farm with a site-specific update last recorded in 2009 (ADEC 2023). Before improvement projects are planned, cleanup coordination should occur with ADEC.



ENG-S-002 Field Inlet

ENG-S-006 Outlet

Figure 5. Select Photos – ENG

Main Street (MNS)

Along Main Street, from Barnes Street to the City of Seldovia Central Park, stormwater is collected by the MNS system. Several individuals and entities informed HDR that water frequently ponds near MNS-S-001. MNS-S-001 is not located in the low point of the road, which contributes to this problem. On the southwest side of Main Street, the system contains another curb inlet (MNS-S-002) and a field inlet (MNS-S-003) within a small, vegetated area, both outfalling via (MNS-S-004) onto the breakwater rock. Both curb lines show sediment accumulation. The parking lot that MNS-P-003 crosses through is poorly drained and does not appear to grade well towards MNS-S-003. MNS-S-004 shows signs of corrosion and is horizontally smashed. During discussions with City Public Works, storage of snow along this stretch of Harbor coastal rock was mentioned and may factor into the condition of the outfall (MNS-S-004).



MNS-S-003 Field Inlet and Parking Lot

MNS-S-004 Outlet

Figure 6. Select Photos – MNS

Alder Street (ALD), Winifred Avenue (WIN), Anderson Way (AND), Lipke Lane (LIP), and Seldovia Street (SEL)

ALD, WIN, some of AND, LIP, and SEL systems are joined. Field inspections started at the northwest end of Alder Street and were based off a 1984 *Alder Street Drainage Improvement* preliminary plan set, developed by CH2MHill, that showed an existing and proposed stormwater



system. However, after discussions with City Public Works and through field investigations, the existing system seems to still be intact. ALD-S-001 (field inlet) is not in the low point of the detection basin but instead is situated in its side slope. ALD-S-002* is not located along the gravel road but has been seen by City Public Works in the past. Where Alder Street and Winfred Avenue intersect, ALD-S-003 and WIN-S-001 stormwater catch basins have more outlets terminating within them than located pipe inlets. ALD-P-003* is assumed to be a residential connection to the drainage system. The system flows downhill to the Seldovia Street and Anderson Way intersection and connects to the main line at SEL-S-001. A curb inlet (AND-S-001) that drains the northern side of Anderson Way also connects at SEL-S-001. Anderson Way transitions from gravel to pavement near this location.

From the southeast, Lipke Lane and Alder Street flow towards Seldovia Street. Next to the Seldovia Fire Department's door (263 Lipke Lane), LIP-S-001 (round inlet) appears to drain to a perforated, vertical, corrugated metal pipe (CMP); it is assumed that this is a dry well with no outlet pipe. ALD-S-004 and ALD-S-005 (curb inlets) collect flow from Alder Street and have more outlets terminating within them than located inlets. LIP-P-001* could be coming from LIP-S-001, but this could not be confirmed during field inspections. In the gravel parking area of 318 Alder Street, a portion of what is assumed to be a trench drain was seen. From ALD-S-005, flow travels northwest through ALD-S-006 field inlet and then intersects the main line at SEL-S-002. ALD-S-006 drains a vegetated detention basin in front of the north side of the Seldovia Fire Department. SEL-S-002 consists of a round inlet located in the curb line and travel lane.

The SEL system continues down Seldovia Street, collecting flow from Garden Street, the post office (251 Seldovia Street), and the Seldovia Public Library (260 Seldovia Street). Adjacent to Seldovia Street, Lipke Lane has an inverted road section with drainage along the center. It drains south to a rectangular inlet (LIP-S-003) and enters the SEL system via LIP-P-002. At SEL-S-004, flow collects from SEL-S-003 and SEL-S-004 (curb inlets) and from LIP-P-002. The two inlets are connected by a plastic thaw wire that neither the City nor DOT&PF recalls ever using.

The SEL system crosses Main Street and collects flow along Main Street from the City of Seldovia Central Park to Harborview Drive via SEL-S-005 (curb inlet). The system then outfalls onto the harbor's breakwater via SEL-S-005. This outfall is in good condition.

There are active ADEC contaminated sites within this drainage basin. The "Seldovia Tank Farm" contaminated site, described in the *English Drive (ENG)* section, is located up-gradient of the ALD system. The "Hopkins Construction Company" contaminated site appears to be located within this drainage basin as well and has a record of petroleum-contaminated groundwater, with ADEC records spanning from 1994 to 2021 (ADEC 2023). Before improvement projects are planned, verification and cleanup coordination should occur with ADEC.



ALD-S-001 Field Inlet

SEL-S-002 Inlet



LIP-S-002

SEL-S-006 Outlet

Figure 7. Select Photos – ALD, SEL, and LIP

Harborview Drive (HBR)

HBR consists of two curb inlets (HBR-S-001 and HBR-S-002) that drain Harborview Drive at its southwest end. Harborview Drive and southeastward roads generally consist of residential properties except along Main Street, where there is a concentration of commercial properties. There was some fine sediment accumulation in the curb lines, in front of the curb inlets, and in the outfall pipe (HBR-S-003). Otherwise, the system is in fair condition, outfalling onto the breakwater.



HBR-S-002 Curb Inlet

HBR-S-003 Outlet

Figure 8. Select Photos – HBR

Fulmor Avenue (FUL)

FUL consists of two sets of three curb inlets located at the Alder and Main streets intersections. The first set of curb inlets, at Alder Street, appears to be in fair condition with a moderate amount of sediment and water accumulation. FUL-S-001 has a different style inlet grate than what was commonly found during the inspection. The City mentioned that a drainage pipe (FUL-P-003) at 240 Fulmor Avenue was hit. The HDR team briefly spoke with the contractor to verify that the drainage pipe had been repaired to provide connectivity for the upstream network. A low spot in the pavement at 240 Fulmor Avenue ponds water. After some investigation, the downstream manhole (FUL-S-004) was located and exposed by the HDR team in the front yard of 232 Fulmor Avenue.

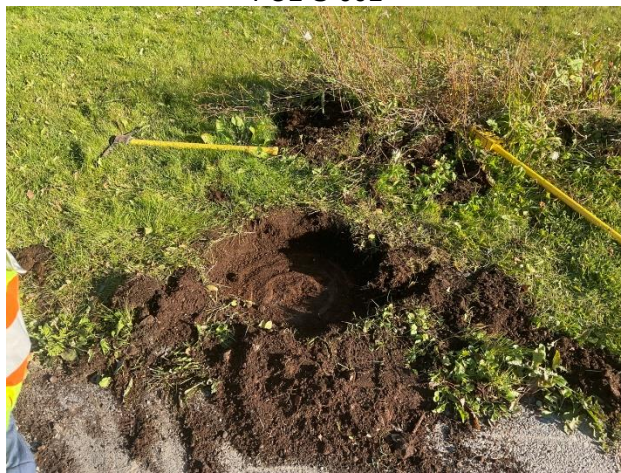
The second set of curb inlets, at Main Street, appear to be in fair condition with water accumulation in their sumps. FUL-S-005 does not appear to be located in the low spot, as indications of ponding near it are present. FUL-S-007 has a partially broken inlet grate, has some fine sediment accumulation in its curb line, and collects flow from the west side of Main Street. Additional dirt/gravel parking lots along Main Street show rutting and drainage issues. The outfall (FUL-S-008) to the breakwater is in poor condition with a corroded bottom.



FUL-S-001



In FUL-S-003 Viewing FUL-S-004



FUL-S-004



FUL-S-008 Outlet

Figure 9. Select Photos – FUL

Peninsula Street (PEN)

The PEN drainage system consists of two, large catch basins, PEN-S-001 and PEN-S-002. Both have curb and gutter inlet grates and concrete rectangular catch basin boxes, unlike most of the other curb inlet configurations, which consist of a curb inlet grate over a round concrete manhole. Both have heavy sediment accumulation; the HDR team dug out the inlet pipe in PEN-S-001. PEN-S-001 is not located in the low spot, and significant ponding occurs just down-gradient of the curb inlet. The inlet to PEN-P-002 was seen exiting PEN-S-002 but the outlet (PEN-S-003*) is not located in the breakwater. Community input and field observations also noted significant ponding in front of 194 Main Street and the Gateway Pavilion.



PEN-S-001 Inlet Grate

PEN-S-001



Ponding in Front of Gateway Pavilion

Parking Lot Ponding

Figure 10. Select Photos – PEN

Kachemak Street (KAK) and Willow Street

City Public Works Operators discussed the limited right-of-way and steep vertical roadway curves on Kachemak Street that cause drainage and snow removal constraints. The KAK system is short, as most of the drainage surface flows directly into the Slough. However, property lines, fences, and accessory buildings along the southern portion of the street are nearly adjacent to the edge of the roadway, limiting the existing drainage routing. Ponding and road ruts were noted in front of 234 Kachemak Street.

Willow Street appears to flow to both the northwest and southeast, with shallow ditches along its southern side. At the intersection of Kachemak and Willow streets, a field inlet (KAK-S-001) collects flow from the shallow, southwestern ditch and conveys it across Kachemak Street to outfall north of 246 Kachemak Street (via KAK-S-003). During field inspections, KAK-S-001 was dug out and consisted of an upside-down beehive-shaped inlet grate lined with weed barrier fabric, which is assumed to prevent dirt and debris from entering the piped system. The 2010 *Water and Sewer Improvements* record drawing (City 2023) shows a turn in the pipe that is assumed to require a manhole structure (KAK-S-002*); however, the structure was not located during the field inspection. The outfall, KAK-S-003*, was located and appears to be in good condition, outfalling into rock riprap before flowing into the Slough.

Although LSU is partially located on Kachemak Street, it is discussed in its own section.



KAK-S-001 Field Inlet

KAK-S-002 Outlet

Figure 11. Select Photos – KAK

Airport Avenue (ARP)

The ARP system describes four separate drainage systems along Airport Avenue, from Kachemak Street to where Airport Avenue transitions from pavement to gravel, towards the Seldovia Airport. Two of these drainage systems (ARP-S-001 through ARP-S-006) are at the ends of the Seldovia Slough Bridge. The west end system consists of a curb inlet catch basin (ARP-S-001), a junction structure that directs flow at a 90-degree angle (ARP-S-002), and a flume (ARP-P-003) that provides erosion protection down the embankment. The east end system consists of a curb inlet catch basin (ARP-S-004) and an outlet pipe (ARP-S-005) that directs flow down the dirt embankment. In addition to the curb inlets, the Slough Bridge has deck drains sawed through the wood decking along its southern shoulder; many of these are plugged with sediment. One of the public comments mentioned noticeable turbidity in the street drainage by the Slough Bridge. The area that this comment referred to was not definitively determined, but road runoff from Kachemak Street's gravel road and Airport Avenue from the northeast were noted as a potential sources of stormwater turbidity. Additional investigation of this area should be conducted to determine if stormwater turbidity could be improved.

The other two systems are located near the Airport Avenue pavement-to-gravel transition and consist of a cross culvert and a curb inlet drainage system. The cross culvert (ARP-P-005) drains the area along the southern side of the road. Curb inlets (ARP-S-006 and ARP-S-007) drain flow from the road curbs. Both systems outfall on the northern side of the road into Seldovia Slough. DOT&PF mentioned that ARP-P-006 and ARP-P-007 are collapsed and are to be replaced in the next Airport improvements project (currently in design phase).



ARIP-S-003 Outlet and ARP-P-003 Flume



Seldovia Slough Bridge Deck Drains



ARP-P-005 Outlet



ARP-S-008 Outlet

Figure 12. Select Photos – ARP

Augustine North Avenue (AUS) and D Street (DST)

AUG-P-002 cross culvert provides driveway drainage across 150 Augustine North Avenue. A shallow ditch directs flow to DST-P-001 inlet. Flows are directed down D Street, through a manhole (DST-S-001), and outfall beside a residence at 165 Augustine North Avenue. DST-S-001 appears to be in good condition with some cobbles accumulated within it. DST-S-002 appears corroded and crushed within a pile of riprap rock. Seldovia Slough tide elevations may contribute to corrosion of this outlet. There appears to be some roadway ponding on the southwest corner of D Street and Augustine North Avenue.



DST-S-001 Manhole

DST-S-002 Outlet

Figure 13. Select Photos – DST

A Street (AST), Augustine North Avenue (AUS), C Street (CST), Eider Lane, and Willards Way (WIL)

Two cross culverts (AST-P-001* and AST-P-002) were found at the southern end of Augustine North Avenue, along the drivable portion of A Street. The inlet of AST-P-001* was not located. These pipes direct flow into a deep ditch along the eastern side of Augustine North Avenue. Flow crosses Augustine North Avenue through AUG-P-001, which is submerged at both ends. Flow meanders in a ditch along C Street and crosses C Street via CST-P-001. Sediment was dug out of the inlet of CST-P-001, and its outlet was found to be submerged. Surface flow from Eider Lane also contributes to this system. Some road rutting was noted at the southeast intersection of Eider Lane and C Street. Flow is otherwise contained in ditches that meander through properties north of C Street, along the southern roadway of C Street, and along the eastern roadway of Willards Way. The northern side of C Street contains two additional cross culverts (CST-P-002 and CST-P-004). WIL-P-001 resides on private property at the southern end of Willards Way that joins with C Street drainage at CST-P-003 and crosses via CST-P-004. CST-P-004 appears to have a corroded bottom at its inlet end. Upstream of CST-P-005, plastic blocks in the ditch that may limit or backwater flow were observed. CST-S-001 outfalls into Seldovia Slough and appears to be in good condition, with a moderate amount of flow.



Figure 14. Select Photos – CST

B Street (BST)

Generally, drainage along B Street is via sheet flow directly into the Seldovia Slough. Flows down the hillside are more channelized and cross a private road via BST-P-001.

Winifred Avenue (WIN) and Anderson Way (AND)

Along Winifred Avenue, flow from the School collects in the shallow, roadway drainage ditch and crossed at WIN-P-001. Drainage flows to the northeast and crosses the intersection of Winifred Avenue and Anderson Way via WIN-P-002. Public input mentioned issues with surface drainage along the southern side of Winifred Avenue through this area. A driveway cross culvert (AND-P-002) at 309 Anderson Way was located but no additional culverts were located along 333 Anderson Way. Road rutting and ponding were noted on the eastern side of 333 Anderson Way. Additional investigation should be conducted to determine exactly where existing drainage issues occur and if additional drainage structures exist.

Flow from the hillside and roadway ditch along Anderson Avenue cross via AND-P-003. Along Anderson Way, about halfway between the City's lot and the intersection with Shoreline Drive, a sizable channel with flow could be seen from the road. This flow is assumed to be from the hillside,

but it could not be followed past the edges of the City's lot due to debris piles at the north end of the lot. AND-P-003 contributes to the SHL system.

Service Lane and Young Street (YNG)

No drainage infrastructure is located along Service Lane. Flow appears to shed off the hill and road fairly well. The top of a metal pipe (YNG-P-001*) is located in the road surface, but the outlet was not located, so it is assumed to be plugged. On a 1983 *Street Rehabilitation* plan set by CH2MHill, the pipe is detailed as a 4-inch-diameter steel drain pipe (City 1993).

Across Anderson Way, street and residential drainage flows into the marshes, bogs, and wetlands on both sides of Young Street via YNG-P-002. Flow from YNG-P-002 drains into the marsh area that contributes to the SHL system.

Shoreline Drive (SHL) and Malcom Street

Shoreline Drive generally drains towards a marsh at its north end or surface-flows into the Seldovia Slough along its eastern side. SHL-P-002 drains a marsh area into the Seldovia Slough. The pipe is in poor condition and highly corroded, likely due to the tide elevations. Road rutting near and over SHL-P-002 was also noted.

Half of Malcom Street flows towards the marsh, and the other half flows towards Shoreline Drive, where it surface flows off the road and into the Slough. SHL-P-001 is located in a shallow ditch near 313 Shoreline Drive. The inlet of the pipe has a short metal bridge above it, and the outlet of the pipe can be seen below the guard rail, outfalling down the steep dirt embankment. Road rutting and ponding were noted near 271, 313, and 337 Shoreline Drive.



SHL-P-002 Outlet

SHL-P-002 Outlet Downstream

Figure 15. Select Photos – SHL

Bloch Street (BLC)

Bloch Street generally sheet drains directly into the marsh that parallels its southern side. There is a low spot near 389 Bloch Street that contains a cross culvert (BLC-P-001) that allows for drainage towards Lake Susan. This culvert is located near electrical utility boxes.

Lake Street, Lake Susan (LSU), and Cedar Street

Along Lake Street and Kachemak Bay, there is an outfall for Lake Susan. A 1992 *Proposed Overflow Pipe for Susan Lake* plan sheets, by CH2MHill, details the installed piped system (City 1992) and is provided in Appendix B. A resident in the area provided some history of the lake overflow pipe. The SVT stakeholder meeting also covered some of the history of the lake, discussing its lowering water surface elevation over time and increased growth of lily pads during the summer. Studies have previously been conducted investigating and discussing the lake's life cycle. The system's lake outlet structure is located behind 351 Lake Street. It is a small rectangular weir at the entrance to a 24-inch CMP (LSU-P-001). The first manhole (LSU-S-001*) in the system could not be located, but the second manhole (LSU-P-002) was located and appears to be in good condition. The outfall into the Slough (LSU-S-003) was located behind 260 Kachemak Street. It is in poor condition with heavy corrosion. Similar to other outlets in the Slough, the pipe's condition is likely due to tidal proximity.

At the intersection of Cedar, Lake, and Kachemak Street, several road ruts and indications of ponding were seen. Additional ponding was noted along Cedar Street, in front of the Seldovia House. Generally, Cedar Street drainage flows to the north, with some flow collecting in a small ditch along the corner of Cedar and Willow streets.



LSU-P-001 Inlet

LSU-S-003 Outlet

Figure 16. Select Photos – LSU

Rocky Street (RKY) and Frank Raby Drive (FKR)

Rocky Street drains towards Frank Raby Drive. A driveway cross culvert (RKY-P-001) at 397 Rocky Street was located in a small ditch during the field inspection. The pipe was 75 percent full of sediment and its outlet had to be shoveled out to locate the pipe. The ditch continues north and directs flow through a second pipe (FKR-P-001) under Rocky Street. The inlet is corroded, and the outlet is located within riprap rock on private property. Small to non-existent ditch lines along the southern portion of Frank Raby Drive are likely due to limited right-of-way. Along the eastern side of Frank Raby Drive, what appears to be a material site drains towards the road, with some road rutting and ponding adjacent to the material site's driveway. According to the City, a ditch had to be dug 2022 along Frank Raby Drive to accommodate surface flows flooding coming from the material site. FKR-P-002 (driveway cross culvert) was found with its inlet buried and its outlet submerged. Ditch lines on both sides of Frank Raby Drive widen and deepen along its northern portion. Some road rutting was noted in the dirt/gravel portion of Frank Raby Drive as it transitions onto Airport Avenue.

At Airport Avenue, flow from Frank Raby Road and Airport Avenue are conveyed north by two cross culverts (FKR-P-003 and FKR-P-004). Both pipes have 30- to 50-percent sediment accumulation and have corroded bottoms at their outlet ends. On the north side of Airport Avenue, flows are ditched to the Seldovia Slough.



FKR-P-003 Ditches

FKR-P-003 Outlet

Figure 17. Select Photos – FKR

Seldovia Airport (AIR), Water Supply Road, and Fish Creek (FSH)

The drainage at the Seldovia Airport consists of various drainage swales and cross culverts that drain the airport, taxi ways, parking aprons, and upslope flows coming off the hillside. The easternmost set of drainage swales and culverts (AIR-P-001 and AIR-P-004) direct flow to the south and outlet to Seldovia Slough via AIR-P-006. Along the western side of Airport Avenue, half the flow is directed to the north and the other half is directed to the south. The southern flow ties into the eastern system via AIR-P-002, AIR-P-003, and AIR-P-005. The northern flow drains to the north via AIR-P-007, AIR-P-008, and AIR-P-009*. The inlet of AIR-P-009* was not located but is assumed to drain a portion of the hillside. The northern flow then connects in a piped system (AIR-P-010 through AIR-S-002), which outfalls to a ditch that flows north into the Slough. Generally, the culverts in the Airport's drainage swales are in fair to good condition, consisting of both metal and plastic culverts and pipes with flared end sections. Some contain minor sediment accumulation and vegetation growth.

The runway drains into the Slough to the west and into two drainage swales to the east. Three culverts (AIR-P-012 through AIR-P-014) drain the drainage swales. AIR-P-012 and AIR-P-013 direct flow to the north. AIR-P-014 directs flow to the south. These pipes are in fair to poor condition, showing signs of corrosion, likely due to tidal influence.

The Water Supply Road was driven but not thoroughly inspected as about half of it resides outside of City Limits. The road is quite steep and is assumed to be driven daily for Water Treatment Facility operations. The City has expressed interest in further inspection and recommendations along this road as it is the only route to the community's drinking water supply. Per discussions with DOT&PF, road flooding has been observed at the base of the hillside where the road gradient flattens and runs through the marsh.

Fish Creek crosses Airport Avenue south of the Seldovia Airport and is on the Alaska Department of Fish and Game's (ADF&G) Anadromous Waters Catalog (ADF&G 2023). A 108-inch, round, structural aluminum pipe with no embedment was observed. This crossing has an ADF&G Fish Passage Inventory Database site number of 20303061 (ADF&G 2023). This pipe is tidally influenced and floods during a significant portion of the tide cycle. Spawning and dying fish were seen at this creek during the field inspection. It does not appear to pose an impediment to fish passage.



Figure 18. Select Photos – AIR

Hydrologic Analysis

Environmental Systems Research Institute, Inc., ArcGIS Pro (version 3.1.2) was used to map the existing drainage infrastructure and determine basin delineations. Drainage basins were delineated using 2019 U.S. Army Corps of Engineers (USACE) National Coastal Mapping Program (NCMP) Phase One high-resolution imagery, 2-foot contours developed from the 2019 USACE NCMP Phase One digital elevation model (in North American Vertical Datum of 1988), and KPB GeoHub data for anadromous waters, city limits, facilities, redacted parcels, and roads. Project drainage basins are shown in Appendix E. Their areas are provided in Table 1.

Precipitation

To determine flood flow estimates, historic precipitation data and future estimates were assessed. The 1971–2000 Parameter-elevation Regressions on Individual Slopes Model (PRISM) climate dataset for Alaska was overlaid on the basin areas and a weighted precipitation average was calculated for each basin. While there are newer PRISM data sets available, the 1971–2000 data set is required for the hydrologic analysis used. University of Alaska Fairbanks (UAF) Scenarios Network for Alaska + Arctic Planning (SNAP) Community Climate Charts were also gathered.

Flood Flow Analyses

The 2016 U.S. Geological Survey (USGS) Regression Equations were used to estimate flood flow for various intervals. Additional methods for calculating flood flow will be analyzed in future phases of this project.



2016 USGS Regression Equations

The 2016 USGS regression equations were developed to estimate flood magnitude and frequency for Alaska and conterminous basins in Canada using USGS annual peak flow data through water year 2012. The 2016 USGS regression equations are valid for drainage basins between 0.4 and 1,000 square miles (256 to 640,000 acres). The project basin areas fall below the regression equations range but were used for preliminary analysis. These equations use basin area and mean annual precipitation to determine flood flow estimates. Using the 1971–2000 PRISM precipitation data and SNAP projections, flood flow estimates were determined for each basin outfall.

To include climate change consideration, the 2016 USGS regressions equations were rerun applying the SNAP Community Climate Charts data as an adjustment factor on average mean annual precipitation. SNAP Seldovia data for 2030 through 2099 suggest a 6.8 percent increase in precipitation over the typical design life of stormwater structures (UAF 2023).

Results

Flood flow events are defined by their recurrence interval or as an Annual Exceedance Probability (AEP). A recurrence interval (or return period) is described as the average number of years between floods of a certain size and is based on the probability that the given event will be equaled or exceeded in any given year. An AEP is the percent chance of occurrence in any given year and is always provided as a fraction of 1. For example, a 5-year recurrence interval flood is a 0.2 AEP flood (1/5) or has a 20 percent chance of occurring in any given year. AEP is the preferred terminology, as it reminds the user that a flood event is not related to a specific time interval but instead as a chance of occurring.

The flood flow estimates for each outfall are provided in Table 1. Calculations used to determine project flood flow estimates are provided in Appendix F.

**Table 1. Estimated Flood Flows by Outfall**

2016 USGS Regression Equations with SNAP Adjustment									
Stormwater System	Basin Size (acres)	% AEP / Recurrence-Interval Flood (cfs)							
		50%	20%	10%	4%	2%	1%	0.50%	0.20%
		Q2	Q5	Q10	Q25	Q50	Q100	Q200	Q500
Airport NE	10.5	1.4	2.8	4.1	6.1	7.7	9.6	11.6	14.6
Airport NW	6.4	0.9	1.9	2.8	4.1	5.3	6.6	8.1	10.2
Airport SE	37.9	4.0	7.8	11.1	16.0	20.0	24.6	29.4	36.4
Airport SW	2.6	0.4	0.9	1.4	2.1	2.7	3.5	4.2	5.4
Airport Avenue	13.6	1.7	3.5	5.0	7.4	9.3	11.6	14.0	17.5
Augustine North Avenue	1.0	0.2	0.4	0.7	1.0	1.3	1.7	2.1	2.7
B Street	1.0	0.2	0.4	0.7	1.0	1.3	1.7	2.1	2.7
Bridge Drainage West	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4
C Street	43.2	4.3	8.4	11.9	17.1	21.4	26.3	31.4	38.8
City Boat Yard	6.7	0.9	1.9	2.9	4.3	5.4	6.8	8.3	10.4
D Street	3.0	0.4	1.0	1.5	2.2	2.9	3.7	4.5	5.7
English Drive	4.5	0.7	1.4	2.1	3.1	4.0	5.1	6.2	7.8
Frank Raby Drive East	5.9	0.8	1.7	2.5	3.8	4.8	6.1	7.4	9.3
Frank Raby Drive West	5.7	0.8	1.7	2.5	3.7	4.8	6.0	7.3	9.2
Fulmor Avenue	5.5	0.7	1.6	2.4	3.6	4.6	5.7	7.0	8.9
Haborview Drive	1.5	0.3	0.6	0.9	1.3	1.8	2.2	2.8	3.5
Illiamna Street	2.0	0.3	0.7	1.1	1.7	2.2	2.8	3.4	4.4
Kachemak Street	1.1	0.2	0.5	0.7	1.1	1.4	1.8	2.2	2.8
Lake Street	16.0	1.9	3.8	5.5	8.1	10.2	12.7	15.3	19.1
Main Street	2.6	0.4	0.9	1.3	2.0	2.6	3.3	4.1	5.2
Peninsula Street	1.7	0.3	0.6	1.0	1.5	1.9	2.5	3.0	3.9
Seldovia Street	12.9	1.5	3.2	4.6	6.8	8.6	10.7	13.0	16.3
Shoreline Drive	40.5	4.1	8.0	11.4	16.4	20.5	25.2	30.2	37.3
Spring Street	11.2	1.4	2.9	4.2	6.2	7.9	9.9	11.9	15.0
Spruce Street	4.3	0.6	1.4	2.0	3.0	3.9	4.9	6.0	7.6
Young Street	2.0	0.3	0.8	1.1	1.7	2.2	2.8	3.5	4.5

Notes: cfs = cubic feet per second; in. = inch(es).



Water Quality

Untreated stormwater discharges to receiving waters can increase flooding, sedimentation, and erosion, and can introduce pathogens and other pollutants that can present risks to human health and aquatic communities. Stormwater-related pollution can be significant if the flow is untreated and is directly conveyed into the downstream water body. Common sources of stormwater pollutants include conveyance of sediment, fertilizers, pesticides, pet and other animal feces, oils, greases, petroleum hydrocarbons, and excess bacteria; road treatment chemicals (salts); snow melt storage activities; overflow of untreated sanitary sewage during heavy rainfall or snowmelt; and leaching of heavy metals. Possible sources of stormwater pollutants include streets, gutters, sidewalks, lawns, roof tops, residential driveways, neighborhoods, industrial sites, parking lots, construction sites, and maintenance yards.

While the City is not currently required to follow an ADEC-regulated municipal separate storm sewer system water quality program, it still has a vested interest in the health of its community and the surrounding aquatic environment. The public survey and discussions with the City and residents aimed to identify any known stormwater pollutant concerns. Additionally, areas of potential stormwater pollutants were investigated during the field inspection. No specific areas were identified with major stormwater-related water quality concerns and no common sources of stormwater pollutants were noted. However, general water quality comments for the whole system include boat maintenance and storage yards, street and upland sediment washoff and trackout, road treatment chemicals, and snow removal and storage activities.

During field inspections, several inlet grates were found to be clogged with dirt and organic debris, many catch basins and manholes had accumulations fine sediments up to gravel-sized particles, a few outlets were found to have sediment accumulation along their interiors, and in a few cases, the outlet pipes in a catch basin were completely buried by sediment accumulation in the structure. During discussions with the City and DOT&PF, sand is used for additional road traction in the winter and swept up in the spring. Outside of City limits, DOT&PF uses salt or calcium chloride on the roads as a dust suppressant and infrequently to melt frozen inlets. Within City limits, DOT&PF rarely uses calcium chloride on the roads per the request of the community. Chemicals can be tracked by vehicles and become mobile in stormwater/meltwater, increasing corrosion to stormwater infrastructure. The City and DOT&PF both manage snow removal and storage activities throughout the winter and shoulder seasons due to high precipitation and freezing temperatures. Many of the roads within the community are steep, narrow, and lack easements between the roadway and private property lines, making them challenging to plow and store snow. Both agencies do their best to plow snow and store it as close to its source as possible to cut down on hauling costs. Commonly, snow is piled in locations with available space and pushed onto coastal rock. Snow then melts into adjacent drainage infrastructure or water bodies, transporting and leaving behind sediment. No snow related water quality issues were noted in the public survey or during the site visit.

While its components and effects are yet to be determined, the surface drainage and groundwater seepage along Vista Avenue that contains a large amount of orange flocculant may indicate a water quality concern. Additionally, the City has gotten reports that the water and sanitary sewer mains in on Vista Avenue corrode quickly, which may or may not be connected. Additional investigations are required to definitively determine if the events are connected and water quality is being adversely affected.



Data Gaps

While available record drawings and the field inspection provide a better picture of the existing drainage system, there are still data gaps that would take additional investment to resolve. In future phases of this project, drainage improvement projects will be developed and will help determine the locations of additional investigation of the stormwater system. Additional investigations and precise survey should be conducted for any future design or construction efforts. Survey grade data on the system would help avoid impacts to the stormwater system similar to the incident at 240 Fulmor Avenue that occurred in 2023.

Preliminary Recommendations

Based on compiled existing information and analysis of the whole drainage system, the following general and site-specific preliminary recommendations are proffered:

General Preliminary Recommendations

- Set up long-term planning for drainage easement acquisitions to allow for improved drainage and snow removal management.
- Develop plans for upgrading aging infrastructure to reduce failures and emergency repairs.
- Implement sediment control measures to lessen sediment load conveyed through the drainage system. Continue spring street sweeping and conduct reduction of trackout, catch basin upgrades, and vacuum truck maintenance to reduce sediment loading.
- Coordinate drainage improvements with all stakeholders to procure funding sources and plan for system improvements. While chemicals are not typically used within City limits, continue coordination with DOT&PF to minimize their use on roadways to lessen water quality impacts on downstream receiving waters.
- Utilize areas for detention where possible to promote sediment settling and lessen water quality impacts on downstream receiving waters.
- Develop an operations and maintenance plan for drainage infrastructure.
- Draft residential and commercial guidelines or regulations for new developments to reduce future impacts from these activities.

Site-Specific Preliminary Recommendations

- While not exclusively stormwater, surface drainage and groundwater seepage along **Vista Avenue** contains a large amount of orange flocculant, and the water and sanitary sewer mains in this area have been reported to corrode quickly. While not included in the scope of this project, investigations to resolve further corrosion may be desired.
- Improving grading and drainage for the gravel **parking lots** along the west side of **Main Street**. Regrade parking lots and vegetated detention swales to drain towards existing stormwater inlets. Ensure that stormwater inlets are free of debris to maximize catch storage capacity.
- Clean up sediment and debris accumulation along **paved curb lines** to lessen sediment load conveyed through drainage system.
- Continue to work alongside the State of Alaska to complete cleanup on active ADEC **contaminated sites** to ensure that stormwater water quality is not being compromised from known sources of contamination.



- Residential development has increased the imperviousness of the contributing area along **Bay Street** and likely has increased stormwater flow. Develop an improved drainage solution at the road to timber Historic Boardwalk transition.
- Investigate **Winifred Avenue, Anderson Way, Shoreline Drive, Kachemak Street, and Slough Bridge** surface drainage further to determine the locations of drainage issues and potential solutions.
- Investigate previous studies of **Lake Susan** to determine if the lake's water surface elevation can be maintained. If feasible, determine if adjusting the **LSU drainage system** could affect the longevity of the lake and estimate the existing system's remaining life.
- Current stormwater infrastructure along **Frank Raby Drive** has limited capacity due to right-of-way constraints. Further investigation of solution alternatives is recommended to implement an improved drainage solution.
- **Water Supply Road** is notably steep and provides required, daily access to the City Public Works Operators to maintain the drinking water supply to the City. A portion of the road is within City limits; however, the whole road should be investigated further to identify locations of erosion to develop erosion prevention measures.



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Appendix A – Acronyms and Abbreviations

°F	degrees Fahrenheit
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AEP	annual exceedance probability
City	City of Seldovia
CMP	corrugated metal pipe
DEM	digital elevation model
DOT&PF	Alaska Department of Transportation and Public Facilities
EIT	Engineer-in-Training
FPID	Fish Passage Inventory Database
GIS	geographic information system
HDR	HDR Engineering, Inc.
KPB	Kenai Peninsula Borough
NCMP	National Coastal Mapping Program
NRCS	National Resources Conservation Service
PE	Professional Engineer
PRISM	Parameter-elevation Regressions on Individual Slopes Model
SNAP	Scenarios Network for Alaska + Arctic Planning
UAF	University of Alaska Fairbanks
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey



Appendix A – Abbreviated System Names

AIR	Seldovia Airport
ALD	Alder Street
AND	Anderson Way
ARP	Airport Avenue
AST	A Street
AUS	Augustine North Avenue
BLC	Bloch Street
BST	B Street
BYD	City Boat Yard
CST	C Street
DST	D Street
ENG	English Drive
FKR	Frank Raby Drive
FUL	Fulmor Avenue
HBR	Haborview Drive
ILI	Illiamna Street
KAK	Kachemak Street
LSU	Lake Susan
MNS	Main Street
PEN	Peninsula Street
SEL	Seldovia Street
SHL	Shoreline Drive
SPR	Spring Street
SPU	Spruce Street
VIS	Vista Avenue
WIL	Willards Way
WIN	Winifred Avenue
YNG	Young Street



Appendix B – Community Involvement Documents



Seldovia Drainage Mapping & Stormwater
Management Plan Update
C/O HDR
582 E 36th Ave
Anchorage, AK 99503

***** NOTICE *****

City of Seldovia Drainage Mapping & Stormwater Management Plan

Survey Available

August 21, 2023 - September 29, 2023

**WE WANT
YOUR
FEEDBACK**

www.surveymonkey.com/r/Seldovia



City of Seldovia Drainage Mapping & Stormwater Management Plan

The goal of this project is for the City to develop a Stormwater Management Plan that provides a strategic roadmap tailored to our community's needs.

Your feedback will help make this plan successful!

We want your help identifying drainage and stormwater issues in the City of Seldovia. You are invited to participate in a survey as part of the creation of the City's Drainage Map and Stormwater Management Plan.



Scan Me

Drainage Mapping & Stormwater Management Plan
August 21, 2023 - September 29, 2023
www.surveymonkey.com/r/Seldovia



**Questions or
Comments?**

Phone: (907) 308-4130

Email: connect@SeldoviaStormwaterPlan.com

Respondent ID	Question				
	1	2	3	4	5
	Has a roadway near your property ever flooded due to rain?	Are there culverts in your area that appear to be unmaintained, undersized, or failing?	Does water continue to stand in roadside ditches, roadways, or other channels more than two days after a rain ends?	Has your property or roadway to your property been threatened by eroding creek banks or ditches?	Do you have any concerns with where snow is stored in the winter?
1	(Left Blank)	Under Young Street a few yards east of Anderson way	Along the east side of Anderson way, especially near Young St.	(Left Blank)	When it blocks driveway access
2	(Left Blank)	(Left Blank)	Creates many big potholes	(Left Blank)	(Left Blank)
3	less than once a year	(Left Blank)	Fulmore Ave in front of Stephanie's Radzy's Custer's A frame house	(Left Blank)	(Left Blank)
4	No ditches so the water just runs down the road	There are not enough culverts. The ditches are not maintained or even there	It creates Chuck holes that come back even after the road is graded because they are deep. Look by the school or by Bev Hecks' or shoreline drive towards the bridge or right at the Y below the school	Malcom street has a ditch issue. The water running down the road has created its own ditch in the road	The city is not supposed to be pushing snow into the bay, slough or harbor because of possible contaminants. The snow should be in piles and let melt in the spring
5	Quite often	At the corner	Low spots of our property drain poorly and are often swamping us	(Left Blank)	Snow removed from roadways is stored on our property and often pushed well beyond easement limits.
6	(Left Blank)	On Shoreline between Bev Hecks and Ed Packer's.	Rain stands between Bev Hecks' and Ed Packer's, in front of Laurel Hilts's, and in front of Stan Coleman's. In front of Perley Morrison's and Jared Patterson's. In front of Craig Barnard's. Adjacent to the school ball field. Along the dirt road from Perley's to Inside Beach. All along the dirt road to the airport.	(Left Blank)	The State plows in the fire hydrant on Anderson Way adjacent to the Hilts's property. The large pile of snow next to the fire hall obstructed the view for oncoming traffic at a right angle. Don't know that street name. The one that borders the multipurpose building.
7	Every heavy rain	(Left Blank)	Halfway down Shoreline Drive	(Left Blank)	Please don't pile it up in someone's yard without their okay
8	Everytime we have a hard or constant rain.	(Left Blank)	On Kachemak St. directly behind our house. It accumulates coming down the road and drains directly under our house. It has caused the street side of the house. It has undermined the concrete our house is sitting on and is causing our house to settle severe enough that the front of the house is no longer resting firmly on the posts the support the beam that runs along the front of the house.	Undermining our foundation enough when you are inside the house the slant at the back of the house is extremely noticable.	The city is no longer using our property for a snow dump like they used too.

Respondent ID	Question				
	1	2	3	4	5
	Has a roadway near your property ever flooded due to rain?	Are there culverts in your area that appear to be unmaintained, undersized, or failing?	Does water continue to stand in roadside ditches, roadways, or other channels more than two days after a rain ends?	Has your property or roadway to your property been threatened by eroding creek banks or ditches?	Do you have any concerns with where snow is stored in the winter?
9	Everytime there is rain.	Rocky Street and Frank Raby intersection. Both culverts are damaged and beyond useful life and drain onto Lot 7 causing flooding and reducing property value.	Rocky Street. Cannot access Lot 7 when raining.	The city has created a ditch within my Lot 7 property boundaries.	Snow is pushed into Seldovia Slough and Bay causing turbidity in waters of United States.
10	(Left Blank)	(Left Blank)	Near the pavilion	(Left Blank)	(Left Blank)
11	(Left Blank)	(Left Blank)	142 N Augustine	(Left Blank)	(Left Blank)
12	(Left Blank)	(Left Blank)	During spring snow melt time, it doesn't impact me	(Left Blank)	(Left Blank)
13	Every time it rains or the snow melts there is standing water in front of my house, there are always huge deep puddles near the pavilion	The one drain near the pavilion is to far uphill so there is constantly standing water at that intersection.	On main Street by the pavilion and in front of 142 N Augustine.	(Left Blank)	(Left Blank)

Respondent ID	Question				
	6	7	8	9	10
	Do you have any issues with spring drainage from snow storage?	In the last five years has the water quality of stormwater runoff gotten worse?	Are there other drainage issues, within the city limits, that you would like the city to be aware of?	Do you think there are any projects or programs that would help improve the stormwater system for the city?	Do you have any other stromwater or drainage concerns that you wish to share?
1	(Left Blank)	(Left Blank)	The “storm drains” on both sides of the street by the post office seem to easily plug and ‘create’ a temporary ‘lake’ from time to time. Also, Shoreline in the Bloch and Young vicinity can retain water on the roadway from melt and rain.	(Left Blank)	The right of ways not being used for vehicle ways on Fulmore and Bloch streets are being used for foot and bicycle transit by many in this area, not only the young bike riders, but also adults, including seniors. Especially on the Fulmore section between the picnic gazebo and the Hilt’s property, the walkway is getting churned into a muddy mass by the youths riding the bicycles instead of walking them. It is safer for the youths and for the seniors of the area to walk these paths as opposed to walking on the edge of Andersen Way.
2	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)
3	(Left Blank)	(Left Blank)	sewer very slow drain along Anderson Way St	The main intersection by post office often clogs with slush/ice. Big puddle forms. Same on the bridge.	(Left Blank)
4	The snow melting from storage piles doesn’t create an issue	There have been sheens in the harbor because of oil in the storm drains or fuel tanks leaking in the slough. Some boats still pump their bilges in the harbor and create a sheen	There are contaminated lands within city limits that need attention. ADEC could come in and inspect these lands and properties	(Left Blank)	It is an aging infrastructure and will need to have culverts and sewer system replaced. Look at the lift stations
5	Compacted snow and debris remains on our property months after other snow has melted.	(Left Blank)	(Left Blank)	Maintaining and updating culverts on c street and other streets.	(Left Blank)

Respondent ID	Question				
	6	7	8	9	10
	Do you have any issues with spring drainage from snow storage?	In the last five years has the water quality of stormwater runoff gotten worse?	Are there other drainage issues, within the city limits, that you would like the city to be aware of?	Do you think there are any projects or programs that would help improve the stormwater system for the city?	Do you have any other stromwater or drainage concerns that you wish to share?
6	There is no where for the moisture to go along Kachemak Drive. It would help if some type of drainage function existed there. The moisture has no where to go. Clearing out drains as soon as possible around town would certainly help evacuate the excess runoff. A fair amount pools in front of the Mad Fish, and between the Main Street Garden and the PO. And of course along the boatyard on the pavement. That area is terrible for draining. Also on the main corner across from the liquor store.	This question implies we are judging the water quality? Perhaps we're judging the quantity? I think the water buildup down by the boatyard is better than it has been.	Creek drainage on Vista creates a very icy situation. The drainage at the intersection of Kachemak and Shoreline creates quite a bit of water buildup.	(Left Blank)	"stormwater" Developing the crown on the roads should be made a high priority. Well beyond expending dollars to put in a walking boardwalk along the harbor. We have so many elders walking and traversing the streets and they should be kept safe.
7	(Left Blank)	(Left Blank)	(Left Blank)	I don't know nearly enough about this topic to suggest a project	(Left Blank)
8	(Left Blank)	It's never been addressed especially after they decided to raise Kachemak Street.	(Left Blank)	How about a catch basin that'll divert water out to the slough without eroding the bank or grade the road so the water is on the other side so it goes to the catch basin further down however I feel that would only be a short term solution because it would need constant upkeep and they can't even fix potholes.	Just the damage being done to our property. Pretty bad when we have go and shore up the side of the road ourselves to keep the water from running under our foundation. Not easy.
9	Floods access to my property.	The City of Seldovia does not perform infrastructure maintenance.	The street drainage by slough bridge causes turbidity when it rains.	Entire gravel road system needs to be raised, ditched and install proper culverts.	There are temporary ways to grade roads to make water flow until roads can be raised. Hire a decent grader operator.
10	(Left Blank)	(Left Blank)	City lot near boat ramp near harbor, standing water.	I am not sure what programs are available to keep our slough, harbor and bay protected from contamination.	(Left Blank)
11	(Left Blank)	Just this year my property has been almost completely covered in water	I desperately need a culvert from my property, it could easily cross under the road and drain straight into the slough. Please let me know if is a possibility!	Yes putting in a culvert will greatly improve my property thank you!!!!	Yes my property really needs that culvert!!!

Respondent ID	Question				
	6	7	8	9	10
	Do you have any issues with spring drainage from snow storage?	In the last five years has the water quality of stormwater runoff gotten worse?	Are there other drainage issues, within the city limits, that you would like the city to be aware of?	Do you think there are any projects or programs that would help improve the stormwater system for the city?	Do you have any other stromwater or drainage concerns that you wish to share?
12	(Left Blank)	(Left Blank)	(Left Blank)	Hopefully it’s not going to water treatment plant, if so that should stop	(Left Blank)
13	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)

Meeting Minutes

Date:	Tuesday, November 07, 2023
Time:	1:00 PM – 2:00 PM
Location:	Online Teams meeting
Project:	Seldovia Stormwater Mgmt Plan
Prepared By:	Kacy Grundhauser, HDR
Subject:	Stakeholder Meeting – Seldovia Village Tribe (SVT)

1. Introductions

Entity	Team Member Name	Task Assignment	Phone	Email
SVT	Crystal Collier	President/CEO		
Seldovia	Heidi Geagel	City Manager		
HDR	Bill Spencer, PE	Senior Engineer		
HDR	Kacy Grundhauser, EIT	Deputy Project Manager		

2. Topics

Discussed a few locations in town that influence SVT directly or that Crystal has seen change over her life. Six locations were discussed and are shown below (these are also recorded in our GIS Stakeholder points.) The purple arrow indicates SVT's administration building.



- a. SVT is building a new clinic on Fulmore Ave. Fall 2023 construction hit the stormwater pipe that goes through that property, well within the property line. (Bill and Kacy were actually in the field right after this happened and talked to construction about this.) Crystal



mentioned it will be nice to know where the drainage system is so something like this can be avoided in the future.

b. Curb Inlets

- i. Airport Ave. curb inlets work well, near the parking lot of the administrative building. There is pooling near the pavilion, also mentioned by other community members and investigated while on site. The City has this location marked for a CIP next year and is interested in what HDR's recommendation is. The City is planning to put more inlets/ drainage infrastructure in. (Bill and I thought the inlets did not appear to be in the low spot of the road, therefore were not draining the area well.)
- ii. Fulmore Ave. curb inlets do not work well. There are pools around them and around the inlet across the Main St.
- iii. Seldovia St. inlets have pooling near them, also mentioned by other community members and investigated while on site.
- iv. Main St. curve drainage has pooling near the inlet, also mentioned by other community members and investigated while on site. This inlet does not appear to be in the low spot of the road and Bill mentioned it was weird to have an inlet in the inside of a curve.

c. Lake Susan water surface elevation discussion.

Crystal mentioned she has seen the lake water surface elevation lower over her life, increase in lily pad growth, and decrease recreation potential. Homeowners around the lake have drier backyards but the vegetation/trees now obstruct their view of the lake. Crystal questioned how the Lake outlet elevation was determined and if it should be raised. Bill mentioned the Lake has a weir in the stormwater infrastructure. A picture of the inlet (water from the lake) was viewed and the rust line on the pipe was much higher than the level seen during the site visit. Heidi mentioned that the Lake has been a point of discussion for the community. The operators do monitor the Lake and weir. Discussions of dredging the lake (no natural outlet for sediment) or removing the lily pads have been discussed. It could be a part of the life cycle of the Lake but could also be due to the man made outlet. Crystal would like to see a recommendation for a further study for the Lake be added. Bill mentioned we can add it as a recommendation but our work alone will not provide a solution.

d. Snow disposal.

Crystal mentioned she thought it was likely the biggest source of water contamination. Both Crystal and Heidi noted the high expensive of snow removal and how their scale of community does not have the resources to haul snow. Heidi mentioned she would be interested to see how much space the City needs for snow removal and if that needed space could be divided into various sites around town. Crystal mentions snow removal activities are conducted by SVT, SOA, and the City of Seldovia.

3. Action Items

Action Item	Lead Person/Entity	Due Date
Provide meeting minutes.	Kacy / HDR	
Determine if Zoom can be used instead of other platforms for online meetings.	Kacy / HDR	

Meeting Minutes

Date: Friday, December 15, 2023

Time: 10:30 AM – 11:30 AM

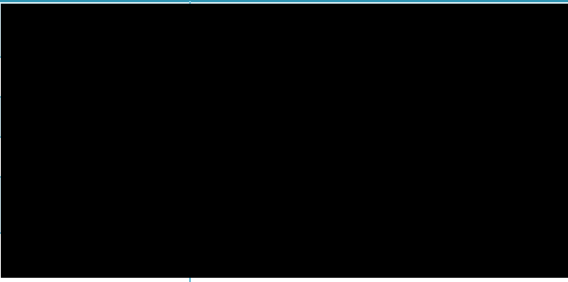
Location: Online Teams meeting

Project: Seldovia Stormwater Management Plan

Prepared By: Alice Horazdovsky, HDR

Subject: **Stakeholder Meeting – Department of Transportation and Public Facilities (DOT&PF)**

Introductions

Entity	Team Member Name	Task Assignment	Phone	Email
DOT&PF	Tyler Tucker	Lead Equipment Operator		
Seldovia	Heidi Geagel	City Manager		
Seldovia	Jan Yaeger	City Finance Officer		
HDR	Irene Turletes, PE	Project Manager		
HDR	Kacy Grundhauser, EIT	Deputy Project Manager		
HDR	Alice Horazdovsky	Public Involvement Coordinator		

Topics

- a) Project intro
 - i) HDR's role in the project is to support the City of Seldovia by putting together a Drainage Mapping and Stormwater Management Plan. The plan will provide the city with a strategic roadmap of potential drainage projects that are tailored to community's needs. The city is conducting outreach with community members via an online survey, and agencies via individual stakeholder meetings, to collect feedback on their needs. The team is currently about 6 months in to a 2-year project.
 - ii) HDR was in Seldovia earlier this year for a week collecting onsite data.
 - iii) During this meeting we hope to learn more about DOT&PF's needs and upcoming projects.
 - iv) Tyler noted that he saw the HDR team this summer and asked when they plan on coming back. Kacy responded that they plan to be back during the summer of 2024. During this year's trip they mapped all existing systems that they could find. She then shared the map of the collected data with meeting attendees.
- b) Storm Water Flooding
 - i) Tyler noted that the airport is his main area of concern since he is currently taking care of it. A resurfacing project is in progress which will replace culverts on airport property.
 - ii) Fish Creek Culvert
 - (1) Tyler added that heavy flows occur during significant rainfall along with the tidal influence. The overflow is close to the road surface, which is concerning. The riprap is in good condition/size so the road most likely won't blow out.
 - iii) Main Street Culverts
 - (1) Tyler asked what data the HDR team collected on Main Street's catch basin and culverts. In the past, DOT&PF would add calcium chloride and salt to prevent freezing throughout the winter.

- (2) Kacy responded that overall, the system is old. The condition of the pipes ranges from average to poor. Some pipes outfalls are corroded out or have catch basins with a buildup of sediment.
 - (3) At the end of Main Street, they were unable to find an outlet to one of the catch basins. The city and homeowners in that area noted that it drained okay but the inlet isn't in the low spot.
- iv) Fulmore Avenue
 - (1) Kacy panned the map to show the 3 catch basins in this area. She mentioned that during field investigations, the bottom of the outlet pipe was found corroded and an upstream pipe of this system was hit by construction earlier in the year.
- v) Harbor View
 - (1) In this location 2 catch basins drain into the harbor.
- vi) Lipke Lane
 - (1) The road is inverted. The catch basin is in the center of the road` and connects to the Seldovia Street.
 - (2) Tyler commented that Seldovia Street and Main Street are notorious for puddling and freezing.
- vii) Main Street Catch Basin
 - (1) Tyler reiterated that puddling and freezing often occur here.
 - (2) Kacy commented that the parking lot has poor drainage. The manholes didn't look too bad although there was some accumulation of sediment.
 - (3) Tyler informed HDR that about 8 years ago, before he started, DOT&PF cleaned out all manholes on paved roads. He added that seeing the project data map is very cool as he can see how all the pieces of the system are connected.
 - (4) Kacy asked Tyler if he has noticed any issues on English Drive. Tyler responded that he hasn't noticed any issues on English Drive.
 - (5) Heidi asked Tyler who is responsible for the drainage along Main Street.
 - (a) Tyler responded that he was unsure. The surface of: Main, Dock, Anderson, Seldovia, and Airport are DOT&PF's responsibility, but he does not know who is responsible for the drainage.
 - (b) Heidi added that she inquired because she wants to know if and how to work with DOT&PF on the results of this Plan.
 - (c) Tyler responded that he definitely wants to be involved, but it would likely be above him. He asked Heidi to send him an email and he will forward it to Sean Montgomery, the M&O Superintendent.
 - (d) Heidi asked Kacy, when they were collecting data onsite, did they evaluate drainage on Water Street and Vista Avenue since this was brought up by the Public Works Operator.
- viii) Vista Avenue
 - (1) Kacy noted that the north side of school drains here. There is a small stream between the properties and a pipe that goes under the walkway.
 - (2) Heidi commented that there is lots of runoff in this area and is concerned about corrosion.
 - (3) Kacy let Heidi know that the property owners said the same thing and that the flow is high even in dry weather conditions.
 - (4) Heidi hopes that the plan will have a suggestion to address this issue.
- ix) Water Supply Road
 - (1) Kacy noted that they still need to delineate the basin for Water Supply Road (outside of City limits). They only drove this road and did not get out to walk and look for culverts. The road is steep and, on a hillside, so runoff from the hill flows onto the road.

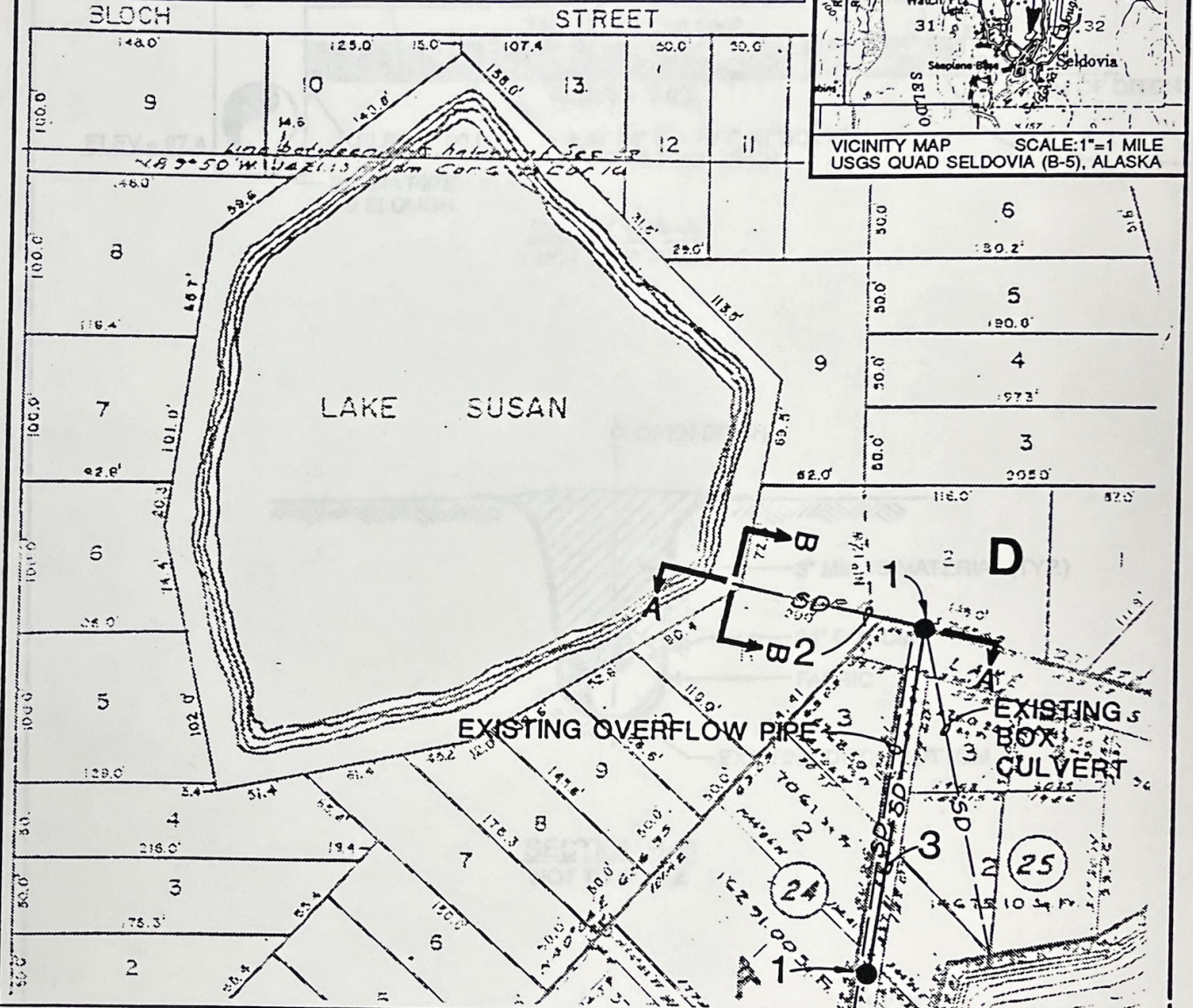
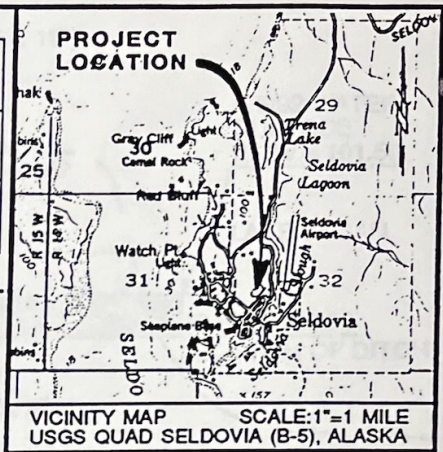
- (2) Heidi asked HDR to include this area in the Plan.
- (3) Tyler added that the puddling is bad in this area, especially at intersection with the Airport. Puddling will often occur in the middle of the road.
- (4) Also, on Airport Avenue, where the pavement ends and gravel starts, two culverts are collapsed. These are planned to be replaced by DOT&PF in the current resurfacing project. He requested for DOT&PF to repave to the airport but there is no guarantee that this will happen. Heidi agreed that paving that road, especially if it included the sidewalks, would be great. Tyler noted that at the top of the hill the ditches are filled with solid rock/shale. Hopefully these issues will be included in the DOT&PF project being designed by R&M.
- (5) Irene inquired if all culverts on the way out to the airport will be replaced.
 - (a) Tyler responded that just this culvert will be replaced since it's collapsed. All others are in good condition although the inlet pans may be replaced.
 - (b) The airport taxiway culverts will be replaced, and the hanger lots and airport parking will be reshuffled. It was noted that this project is currently in design and construction is anticipated to start in 1 to 2 years.
- c) Snow Storage
 - i) Tyler commented the everything in the apron goes into the center drainage ditches and melts out into the culverts. Half the runway drain to infield ditches and the other half drains to the slough.
 - ii) The ditches along the roadsides are used to for snow storage/stacking.
 - iii) Unlike DOT&PF, the city must carry some of its snow to where it can be stored/drained.
 - iv) Tyler added that DOT&PF has a MOU with the City for Main, Dock, Seldovia and Anderson Streets where the city plows and DOT&PF sands. DOT&PF plows the airport to where the pavement ends and out Jakolof Bay Road.
 - v) Tyler added that he tries not to use calcium chloride when he sands the road because of how corrosive it is. If needed he'll use a 50lb bag of salt or calcium chloride.
 - vi) Irene inquired if he hooks to the Seldovia Road thaw pipe. Tyler responded that he has not and was not aware that a thaw pipe existed there. Tyler commented that the city has a portable welder that can be used but they don't have -proper thaw pipe equipment.
- d) Other concerns that relate to Seldovia's drainage and stormwater management.
 - i) Tyler commented that this summer the pavement was fixed by crack sealing. He will also nominate the ditch work on Jakolof Bay Road to take place.
 - ii) If DOT&PF does anything with the culverts during the airport project, then ditching will be involved. He added that it will be nice to have new culverts in that area.
 - iii) Irene added that the Plan may include recommendation for repaving Main Street, Seldovia Street, Dock Street, and Airport Avenue. They will add the planned DOT&PF work into the document since the goal is to help the city prioritize projects and organize grant funding.
- e) Action Item
 - i) Irene will send contact info w meeting minutes
 - ii) Kacy noted that HDR will be back next summer to talk with the city and look at improvement spots. When they are in Seldovia she will set up a time to meet Tyler in person.



Appendix C – City-Provided Maps

The information depicted hereon is for a graphical representation only of best available sources. The Kenai Peninsula Borough assumes no responsibility for any errors on this map

- 1 ABANDON EXISTING STORM DRAIN. INSTALL 4' DEEP STORM DRAIN MANHOLE. (2)
- 2 INSTALL 130 L.F. OF 24" DIA. DULVERT IN EXISTING DITCH.
- 3 INSTALL 270 L.F. OF 24" DIA. CULVERT. DAYLIGHT TO SLOUGH.



PURPOSE: RESTORE LAKE
WATER ELEVATION
OF LAKE SUSAN

DATUM: LOCAL

ADJACENT PROPERTY OWNERS:

PLAN VIEW

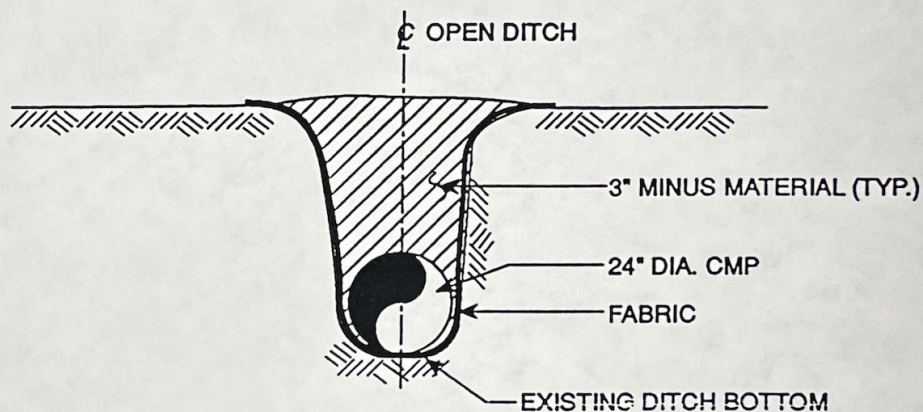
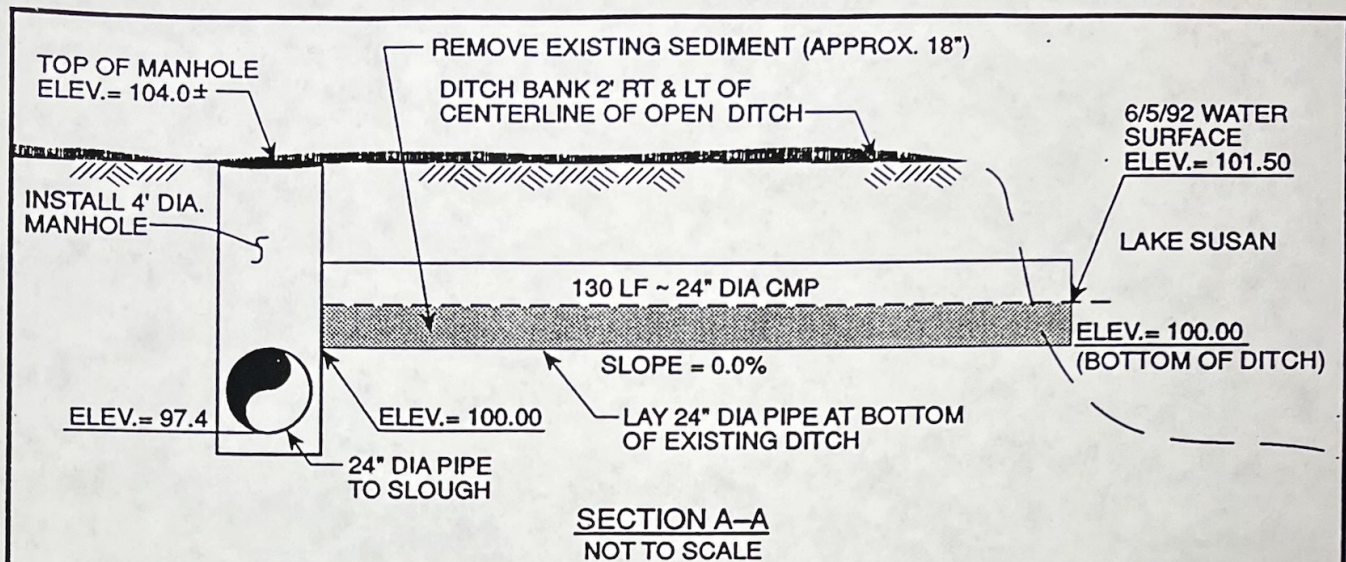
0 50 100
SCALE IN FEET

CITY OF SELDOVIA
P.O. DRAWER B
SELDOVIA, ALASKA 99663

PROPOSED OVERFLOW PIPE
Susan Lake 1 4-910205

IN: LAKE SUSAN
AT: SELDOVIA, ALASKA
APPLICATION BY: CITY OF
SELDOVIA

PREPARED BY CH2M HILL
SHEET 1 OF 2, DATE 3/19/92



REVISED

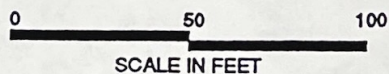
PURPOSE: RESTORE LAKE
WATER ELEVATION
OF LAKE SUSAN

DATUM: LOCAL

ADJACENT PROPERTY OWNERS:

EST. AMOUNT OF FILL: 25 CY

PLAN VIEW



CITY OF SELDOVIA
P.O. DRAWER B
SELDOVIA, ALASKA 99663

PROPOSED OVERFLOW PIPE

IN: LAKE SUSAN
AT: SELDOVIA, ALASKA
APPLICATION BY: CITY OF
SELDOVIA

PREPARED BY: CH2M HILL

SHEET: 2 OF 2, DATE: JUNE 1992



Appendix D – HDR Field Inspection Notes

9/25/23 ^{-Day 1} Seldovia Stormwater Mng Plan

Field Team: B. Spencer, K. Grundhauser

Weather: 50°F, partly cloudy

13:00 @ Alaska Air Taxi

14:00 Depart Anch

14:54 Arrive Seldovia; Heidi picked us up.

15:20 @ lodging, Central Suites.

16:30 Drainage Work Session.

City Manager - Heidi

City clerk - Jan. ^{onsite}

Mayor Campbell - stormwater treatment vs. EOP.

██████ - snow pushed into harbor/slough.

2 main outfalls.

□ Determine snow/winter treatment - "how dirty is the snow?"

□ Road maintenance. ^{some in town.}

City Manager - wetlands, not a lot of city area for treatment but city residents are generally conscious people that may do individual efforts.

state - calcium chloride - Anderson way, Airport, Dust suppressant, uses infrequently.

city manager - they do SAND the streets - in the past, ~8 years, water pipes leaking, old. Corrosive water/sewer. infiltration utilities. →

aging water/sewer infrastructure.

Water system is mostly fixed. But consider.

- City tests water lines for leaks.

Jan Jager - no end point water testing, per the grant.

□ City has snow removal mgr.

Vista - curbside rd.

av. Erosion S. hill, housing foundations.

S. of Main st. ^{from dropped 4ft.}

^{Day 2} 9/26/23 830am, ^{head, too} 1960's - 1970's, after EQ

□ urban renewal, AK state housing w/wnd planning?

□ Snow map - request from City

- City places snow wherever they can.

Filmore - hit ^{storm} pipe @ construction

Seldovia Village tribe & Seldovia Native Village

9:10 Operator John Gruber joined.

Pretty good riprap. Swamp or bedrock.

9:30 Heidi left. Gruber showed us other sites in town - Kachemak, Cst. Bay St Airport, new & old water supply, Frank Ruby Shrubae.

10:30 Returned to City building, got shov, metal detector, & pick (manholes).

10:30-12 looked through archives, located in library building, w/ Jan. ^{Rite in the Rain.}

9/26/23 cont.

12-13:10 lunch & Stormwater Line mapping
in GIS.

13:10 - 16:00 Inventoried N end of town.
Main St.

16:00 - 16:15 Stopped back @ lodging.

16:15 Continued @ north end of town.

20:00 in for the evening. Weather: 50°F, Part Cloud

9/27/23 - Day 3

weather: 43-48°F, sunny/cloudy.

9:30 Main St, piped drainage

13:00 - 13:30 lunch

13:30 Main St continued.

20:30 In for the day.

9/28/23 - Day 4

weather: 39-48°F, Part Cloudy

8:30 met @ City Building.

10:00 met @ City Building.

10:30 At Residence [redacted] on boardwalk.

[redacted] home over

Hole by boardwalk due to neighbor drainage
Retaining wall on E side - from hole
to other end of house.

[redacted] suggested drain on US side, by
neighbor. or grade where boardwalk
meets road.

Concern about R. wall age, installed after
EQ by USACE

11AM left city building

Went down shoreline Dr to the S.

14:30 - 15:30 lunch

15:30 continued @ Kechemache & Lake
Swan outfall

16:30 - 17:10 Talked to [redacted] on boardwalk
and [redacted]

17:10 - 20:30 Inventoried Airport & drove E. edition.

9/29/23 - Day 5

9:00 mapping @ lodging

9:40 Talked w/ Operator Jordan & John Switzer.

Discussed mystery rps & problem locations.

- Approval road permit - DOT & PF, City to
pissy back

11AM Left City Building w/ Jordan to inventory E.
section. [redacted] house is 2nd before school.

14:00 Returned to lodging. Packed up.

15:00 Returned shovel, pick, & magnetic finder to
City. Bid goodbyes. Got Rd's plan set
from Heidi. Can request more w/pw
if needed.

15:30 - 16:00 Smokey Bay Air flight to Homer.

16:00 - 16:20 Taxi, \$7 to main Airport.

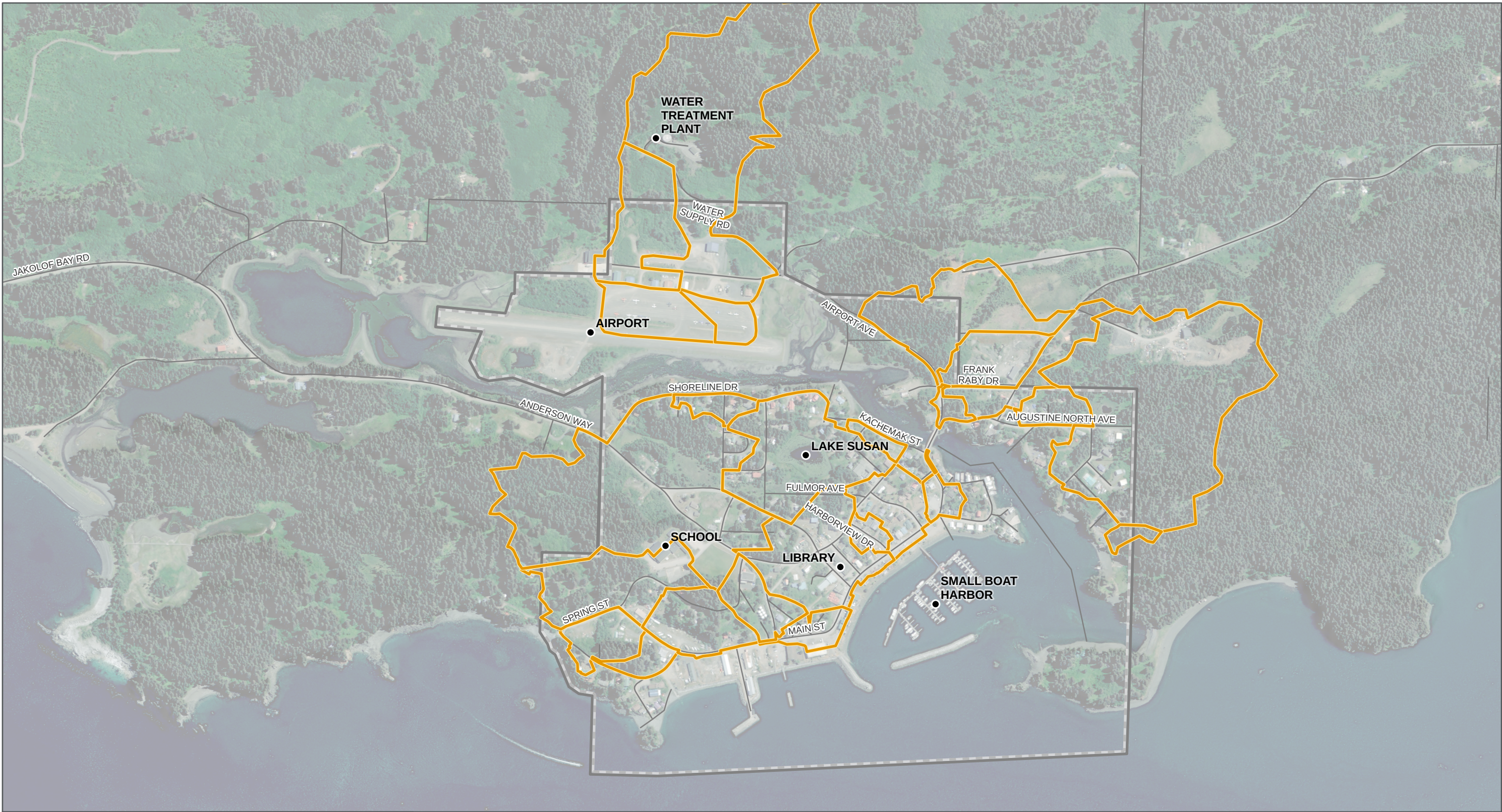
17:00 - 18:00 Raven flight to Anchorage.

CRG

Rite in the Rain.



Appendix E – Drainage Maps



LEGEND

Drainage Basin

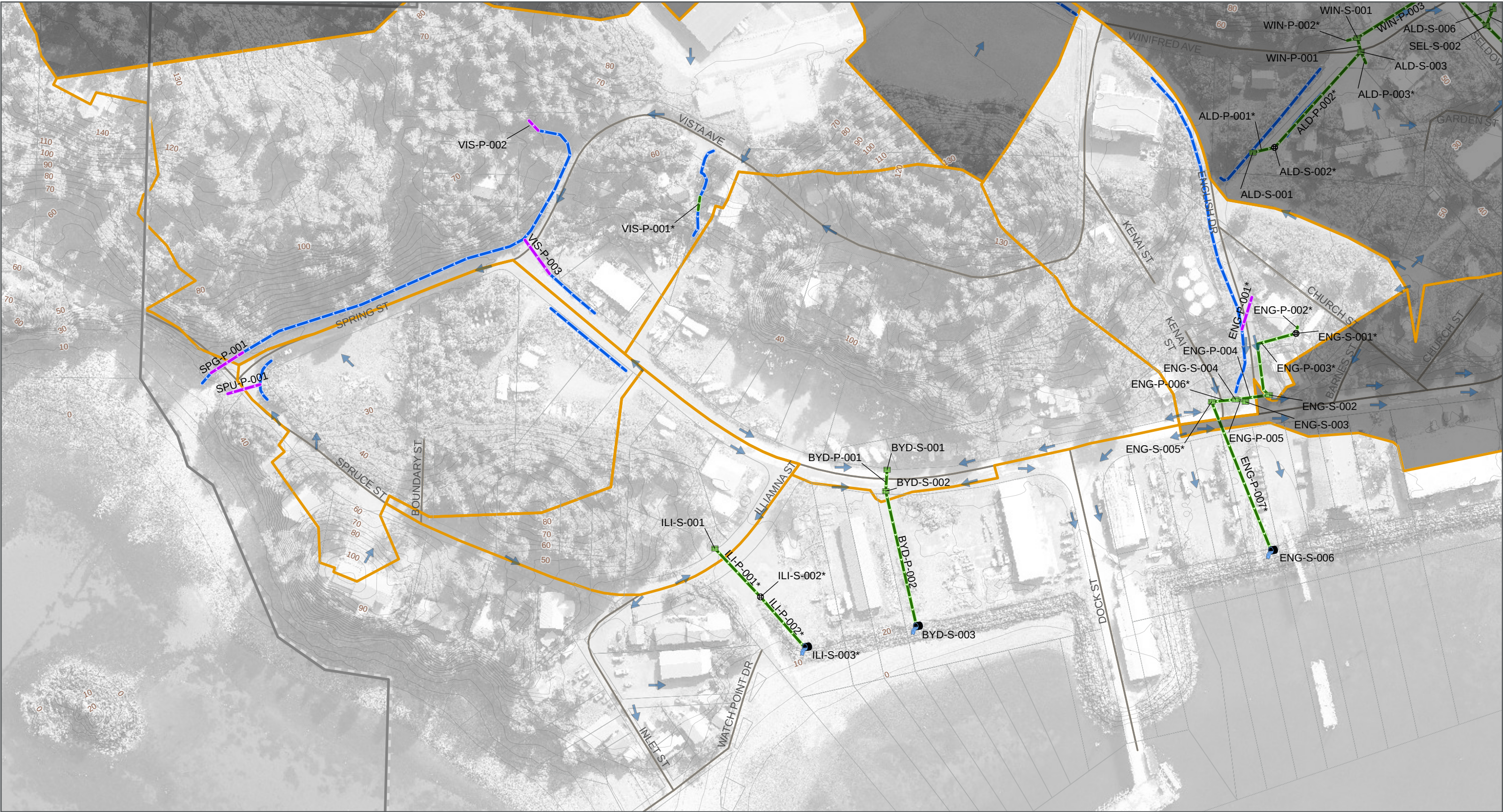
Seldovia City Limits

Roads

SEDOVIA STORMWATER DRAINAGE

OVERVIEW

Figure 1
5/1/2024



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
P-0XX	System Pipe or Culvert
S-0XX	Structure

Abbreviation	System
BYD	City Boatyard
ENG	English Drive
ILI	Iliamna Street
SPG	Spring Street
SPU	Spruce Street
VIS	Vista Avenue

*Location not field verified. Additional investigations and precise survey should be conducted for any future design or construction efforts.

0 150 Feet

SELDOVIA STORMWATER DRAINAGE

MAIN STREET - NORTH

Figure 2
5/1/2024



LEGEND

Stormwater System
→ Surface Flow Direction
● Outlet
■ Catch Basin
⊕ Manhole

— System Pipe

— Culvert

— Open Channel

— Drainage Basin

Reference
[City Limits Icon] Seldovia City Limits
[Parcels Icon] Parcels
[Roads Icon] Roads
[Contours Icon] Contours (5ft)

Abbreviation	Infrastructure
P-0XX	System Pipe or Culvert
S-0XX	Structure

Abbreviation	System
ALD	Alder Street
AND	Anderson Way
HBR	Harborview Drive
MNS	Main Street
SEL	Seldovia Street
WIN	Winifred Avenue

*Location not field verified. Additional investigations and precise survey should be conducted for any future design or construction efforts.

0

150 Feet

▲

AIRPORT

CITY HALL

SMALL BOAT HARBOR

SELDOVIA STORMWATER DRAINAGE

MAIN STREET

HDR

Figure 3
5/1/2024



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldivia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
P-0XX	System Pipe or Culvert
S-0XX	Structure

Abbreviation	System
APR	Airport Avenue
AUG	Augustine North Avenue
BST	B Street
CST	C Street
DST	D Street

Abbreviation	System
FUL	Fulmore Avenue
KAK	Kachemak Street
WIL	Willards Way
PEN	Peninsula Street

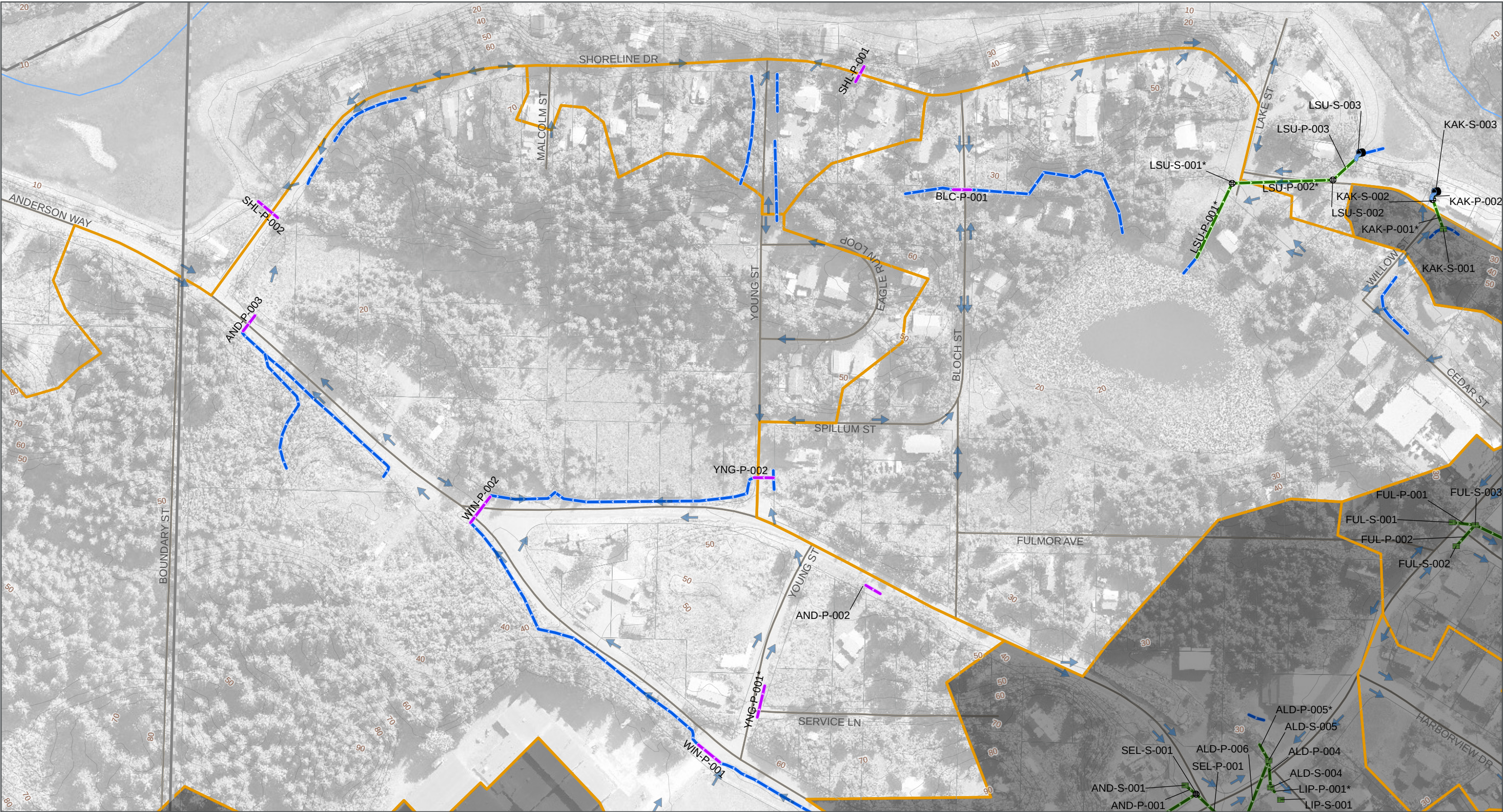
*Location not field verified.
Additional investigations and precise survey should be
conducted for any future design or construction efforts.

0 150 Feet

SELDIVIA STORMWATER DRAINAGE

MAIN STREET - SOUTH & EAST EDITION

Figure 4
5/1/2024



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
P-0XX	System Pipe or Culvert
S-0XX	Structure

Abbreviation	System
AND	Anderson Way
BLC	Bloch Street
LSU	Lake Susan
SHL	Shoreline Drive
WIN	Winifred Avenue
YNG	Young Street

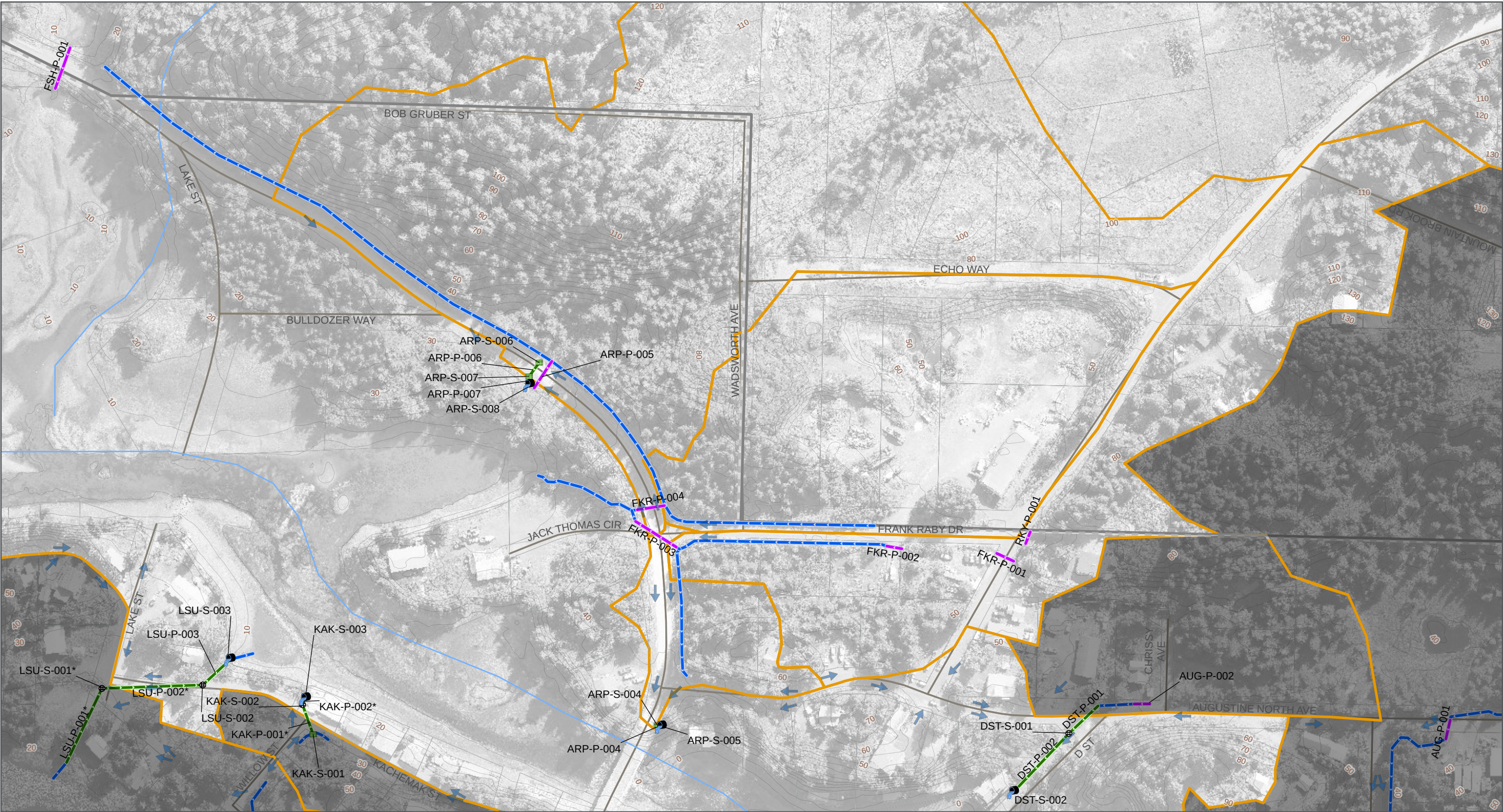
*Location not field verified. Additional investigations and precise survey should be conducted for any future design or construction efforts.

0 150 Feet

SELDOVIA STORMWATER DRAINAGE

SHORELINE DRIVE

Figure 5
5/1/2024



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
P-0XX	System Pipe or Culvert
S-0XX	Structure

Abbreviation	System
APR	Airport Avenue
FKR	Frank Raby Drive
RKY	Rocky Street

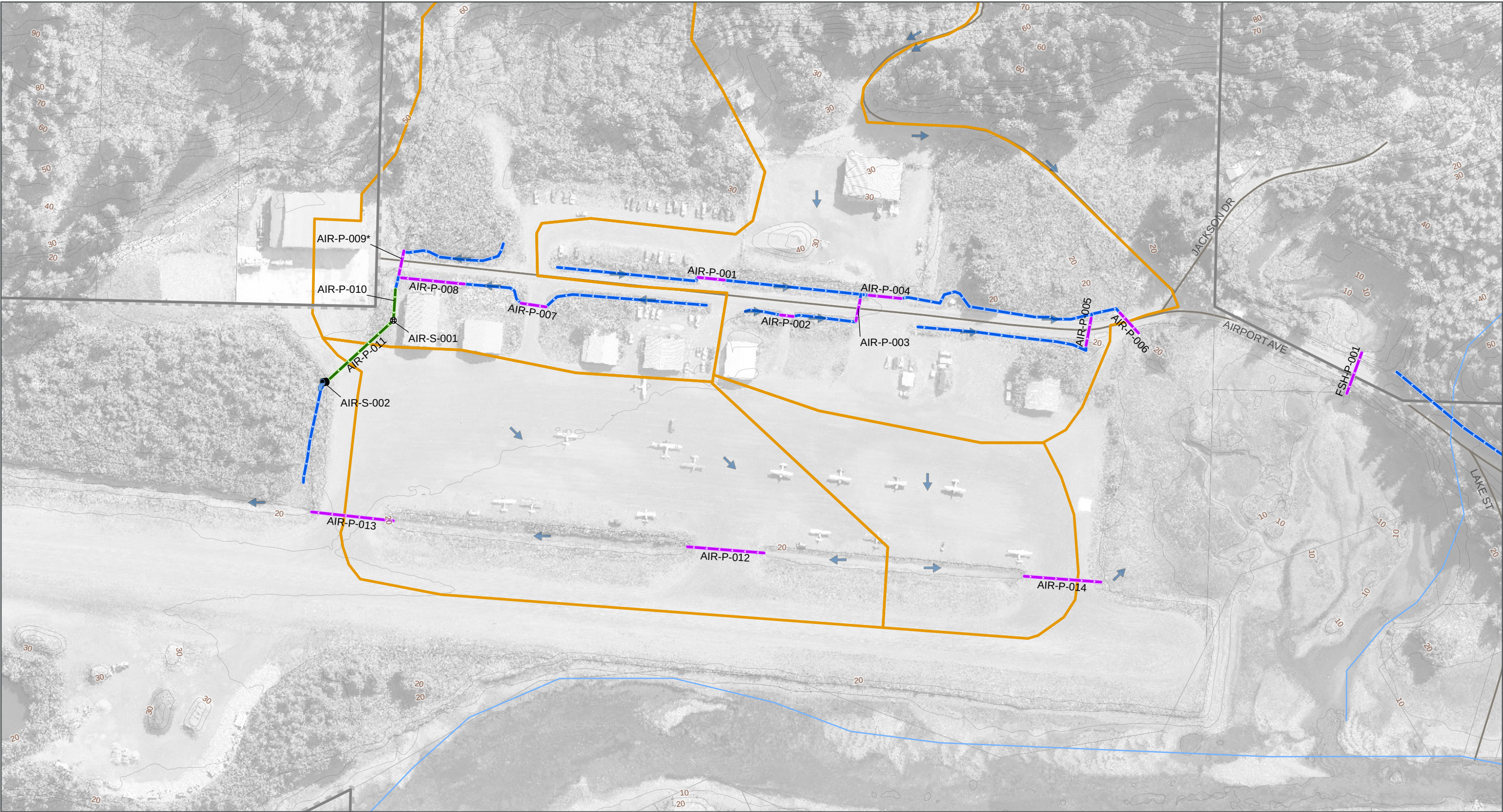
*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.

SELDOVIA STORMWATER DRAINAGE

FRANK RABY DRIVE

Figure 6

5/1/2024



LEGEND

Stormwater System

Surface Flow Direction

Outlet

Catch Basin

Manhole

System Pipe

Culvert

Open Channel

Drainage Basin

Reference

Seldovia City Limits

Parcels

Roads

Contours (5ft)

Abbreviation	Infrastructure
P-0XX	System Pipe or Culvert
S-0XX	Structure

*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.

Abbreviation	System
AIR	Seldovia Airport
FSH	Fish Creek

0 150 Feet

SELDOVIA STORMWATER DRAINAGE

SELDOVIA AIRPRORT

Figure 7

5/1/2024



Appendix F – Supplemental Calculations

Project Name: Seldovia Drainage Mapping

Updated: 12/26/23 K. Grundhauser

Step 1: Use basin size (ft²) to determine which peak flow calculation methods apply by basin size.

Drainage System	Basin Size	Basin Size	Basin Size	Applicable Method
	ft ²	acres	mi ²	
Airport NE	459,208	10.5	0.016	Rational Method and/or TR-55
Airport NW	280,634	6.4	0.010	Rational Method and/or TR-55
Airport SE	1,651,780	37.9	0.06	Rational Method and/or TR-55
Airport SW	114,893	2.6	0.004	Rational Method and/or TR-55
Airport Avenue	591,195	13.6	0.021	Rational Method and/or TR-55
Augustine North Avenue	45,315	1.0	0.002	Rational Method and/or TR-55
B Street	45,234	1.0	0.002	Rational Method and/or TR-55
Bridge Drainage West	2,995	0.1	0.000	Rational Method and/or TR-55
C Street	1,880,019	43.2	0.067	Rational Method and/or TR-55
City Boat Yard	293,958	6.7	0.011	Rational Method and/or TR-55
D Street	129,069	3.0	0.005	Rational Method and/or TR-55
English Drive	198,097	4.5	0.007	Rational Method and/or TR-55
Frank Raby Drive East	255,554	5.9	0.009	Rational Method and/or TR-55
Frank Raby Drive West	246,881	5.7	0.009	Rational Method and/or TR-55
Fulmore Avenue	238,602	5.5	0.009	Rational Method and/or TR-55
Haborview Drive	65,676	1.5	0.002	Rational Method and/or TR-55
Illiamna Street	89,020	2.0	0.003	Rational Method and/or TR-55
Kachemak Street	48,329	1.1	0.002	Rational Method and/or TR-55
Lake Street	698,180	16.0	0.025	Rational Method and/or TR-55
Main Street	112,213	2.6	0.004	Rational Method and/or TR-55
Peninsula Street	75,212	1.7	0.003	Rational Method and/or TR-55
Seldovia Street	560,040	12.9	0.020	Rational Method and/or TR-55
Shoreline Drive	1,762,844	40.5	0.063	Rational Method and/or TR-55
Spring Street	489,732	11.2	0.018	Rational Method and/or TR-55
Spruce Street	188,924	4.3	0.007	Rational Method and/or TR-55
Young Street	89,255	2.0	0.003	Rational Method and/or TR-55

Basin falls within 2016 USGS Regression Equation parameters

Basin falls only within NRCS TR-55 Parameters

Basin falls within Rational Method parameters and NRCS TR-55 parameters

Appendix F – Supplementary Calculations
Project Name Seldovia Drainage Mapping
Step 2: Calculate flows using 2016 USGS Regression Equations, flows incorporating SNAP Climate Data, and flows adjusting for local gage factors.

Updated: 12/26/23 K. Grundhauser

2016 USGS Regression Equations					% AEP / Recurrence-Interval Flood							
					50%	20%	10%	4%	2%	1%	0.5%	0.2%
System	Basin Size	Basin Size	PRISM Precip *	PRISM Precip	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
	ft ²	mi ²	mm*100	in	2016 USGS Regression Flood Flow Estimates (cfs)							
Airport NE	459,208	0.016	97,650	38.4	1.3	2.7	3.9	5.8	7.4	9.2	11.1	14.0
Airport NW	280,634	0.010	96,038	37.8	0.8	1.8	2.6	3.9	5.0	6.3	7.7	9.7
Airport SE	1,651,780	0.059	97,610	38.4	3.7	7.4	10.5	15.2	19.0	23.4	28.0	34.7
Airport SW	114,893	0.004	96,138	37.8	0.4	0.9	1.3	2.0	2.6	3.3	4.0	5.1
Airport Avenue	591,195	0.021	97,818	38.5	1.6	3.3	4.8	7.0	8.9	11.0	13.3	16.7
Augustine North Avenue	45,315	0.002	92,979	36.6	0.2	0.4	0.6	1.0	1.3	1.6	2.0	2.6
B Street	45,234	0.002	92,979	36.6	0.2	0.4	0.6	1.0	1.3	1.6	2.0	2.6
Bridge Drainage West	2,995	0.000	92,979	36.6	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4
C Street	1,880,019	0.067	93,926	37.0	4.0	7.9	11.3	16.2	20.3	25.0	29.9	37.0
City Boat Yard	293,958	0.011	94,856	37.3	0.9	1.8	2.7	4.0	5.2	6.5	7.9	9.9
D Street	129,069	0.005	92,979	36.6	0.4	0.9	1.4	2.1	2.8	3.5	4.3	5.5
English Drive	198,097	0.007	94,240	37.1	0.6	1.3	2.0	3.0	3.8	4.8	5.9	7.5
Frank Raby Drive East	255,554	0.009	93,093	36.7	0.7	1.6	2.4	3.6	4.6	5.8	7.0	8.9
Frank Raby Drive West	246,881	0.009	94,668	37.3	0.7	1.6	2.4	3.5	4.5	5.7	6.9	8.8
Fulmore Avenue	238,602	0.009	92,979	36.6	0.7	1.5	2.3	3.4	4.3	5.5	6.7	8.5
Haborview Drive	65,676	0.002	92,979	36.6	0.2	0.5	0.8	1.3	1.7	2.1	2.6	3.4
Illiamna Street	89,020	0.003	93,554	36.8	0.3	0.7	1.1	1.6	2.1	2.7	3.3	4.2
Kachemak Street	48,329	0.002	92,979	36.6	0.2	0.4	0.7	1.0	1.3	1.7	2.1	2.7
Lake Street	698,180	0.025	93,555	36.8	1.7	3.6	5.2	7.7	9.7	12.1	14.6	18.2
Main Street	112,213	0.004	92,989	36.6	0.4	0.8	1.3	1.9	2.5	3.1	3.9	4.9
Peninsula Street	75,212	0.003	92,979	36.6	0.3	0.6	0.9	1.4	1.8	2.3	2.9	3.7
Seldovia Street	560,040	0.020	93,110	36.7	1.4	3.0	4.4	6.5	8.2	10.2	12.4	15.5
Shoreline Drive	1,762,844	0.063	94,859	37.3	3.8	7.6	10.8	15.6	19.5	24.0	28.7	35.6
Spring Street	489,732	0.018	94,860	37.3	1.3	2.7	4.0	5.9	7.5	9.4	11.4	14.3
Spruce Street	188,924	0.007	94,396	37.2	0.6	1.3	1.9	2.9	3.7	4.7	5.7	7.2
Young Street	89,255	0.003	94,860	37.3	0.3	0.7	1.1	1.6	2.1	2.7	3.3	4.3

*Values calculated in GIS using Zonal Statistics tool with basin polygons and 1 m by 1 m resampled rainfall raster.

Source: Mean Precipitation for Alaska 1971-2000

**See SNAP Data

Basin falls within 2016 Regression Equation parameters
Basin falls outside of 2016 USGS Regression Equations

Appendix F – Supplementary Calculations
Project Name Seldovia Drainage Mapping
Step 2: Calculate flows using 2016 USGS Regression Equations, flows incorporating SNAP Climate Data, and flows adjusting for local gage factors.

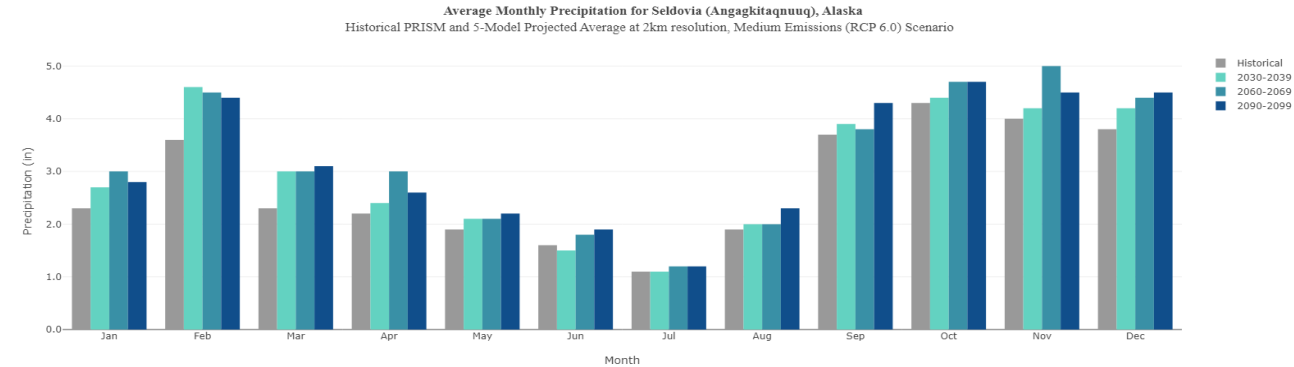
Basin ID	Basin Size	SNAP** Adjusted PRISM Precip	% AEP / Recurrence-Interval Flood							
			50%	20%	10%	4%	2%	1%	0.5%	0.2%
			2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
	mi ²	in	SNAP Adjusted Flow (cfs)							
Airport NE	0.016	41.0	1.4	2.8	4.1	6.1	7.7	9.6	11.6	14.6
Airport NW	0.010	40.4	0.9	1.9	2.8	4.1	5.3	6.6	8.1	10.2
Airport SE	0.059	41.0	4.0	7.8	11.1	16.0	20.0	24.6	29.4	36.4
Airport SW	0.004	40.4	0.4	0.9	1.4	2.1	2.7	3.5	4.2	5.4
Airport Avenue	0.021	41.1	1.7	3.5	5.0	7.4	9.3	11.6	14.0	17.5
Augustine North Avenue	0.002	39.1	0.2	0.4	0.7	1.0	1.3	1.7	2.1	2.7
B Street	0.002	39.1	0.2	0.4	0.7	1.0	1.3	1.7	2.1	2.7
Bridge Drainage West	0.000	39.1	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4
C Street	0.067	39.5	4.3	8.4	11.9	17.1	21.4	26.3	31.4	38.8
City Boat Yard	0.011	39.9	0.9	1.9	2.9	4.3	5.4	6.8	8.3	10.4
D Street	0.005	39.1	0.4	1.0	1.5	2.2	2.9	3.7	4.5	5.7
English Drive	0.007	39.6	0.7	1.4	2.1	3.1	4.0	5.1	6.2	7.8
Frank Raby Drive East	0.009	39.1	0.8	1.7	2.5	3.8	4.8	6.1	7.4	9.3
Frank Raby Drive West	0.009	39.8	0.8	1.7	2.5	3.7	4.8	6.0	7.3	9.2
Fulmore Avenue	0.009	39.1	0.7	1.6	2.4	3.6	4.6	5.7	7.0	8.9
Haborview Drive	0.002	39.1	0.3	0.6	0.9	1.3	1.8	2.2	2.8	3.5
Illiamna Street	0.003	39.3	0.3	0.7	1.1	1.7	2.2	2.8	3.4	4.4
Kachemak Street	0.002	39.1	0.2	0.5	0.7	1.1	1.4	1.8	2.2	2.8
Lake Street	0.025	39.3	1.9	3.8	5.5	8.1	10.2	12.7	15.3	19.1
Main Street	0.004	39.1	0.4	0.9	1.3	2.0	2.6	3.3	4.1	5.2
Peninsula Street	0.003	39.1	0.3	0.6	1.0	1.5	1.9	2.5	3.0	3.9
Seldovia Street	0.020	39.1	1.5	3.2	4.6	6.8	8.6	10.7	13.0	16.3
Shoreline Drive	0.063	39.9	4.1	8.0	11.4	16.4	20.5	25.2	30.2	37.3
Spring Street	0.018	39.9	1.4	2.9	4.2	6.2	7.9	9.9	11.9	15.0
Spruce Street	0.007	39.7	0.6	1.4	2.0	3.0	3.9	4.9	6.0	7.6
Young Street	0.003	39.9	0.3	0.8	1.1	1.7	2.2	2.8	3.5	4.5

Appendix F – Supplementary Calculations

SNAP** Data Seldovia, AK

Month	Precipitation (in)				2030-2099 % Increase
	Historical	2030-2039	2060-2069	2090-2099	
January	2.28	2.72	3.03	2.83	4.3
February	3.62	4.61	4.53	4.41	-4.3
March	2.32	3.03	3.03	3.15	3.9
April	2.24	2.36	2.99	2.60	10.0
May	1.89	2.09	2.13	2.17	3.8
June	1.61	1.50	1.77	1.93	28.9
July	1.10	1.06	1.18	1.22	14.8
August	1.85	2.05	2.05	2.28	11.5
September	3.74	3.94	3.82	4.25	8.0
October	4.25	4.41	4.72	4.72	7.1
November	3.98	4.21	4.96	4.49	6.5
December	3.82	4.17	4.37	4.49	7.5
Annual	32.72	36.14	38.58	38.54	6.8
			6.8	6.6	

Decimal Increase: 1.068



SNAP data collected from UAF Scenarios Network for Alaska + Arctic Planning website:

Data: <https://www.snap.uaf.edu/tools/community-charts>
About: <https://uaf-snap.org/snap-story/community-charts-help-northerners-see-changes/>



Appendix D – Stormwater Infrastructure Summary Table

Stormwater System	Location	History						Existing System			Future Planning		
		History Summary	Year Constructed/ Substantially Modified	Visual Inspections Rating	Annual Cost Impact	Stormwater Public Feedback	Community Impact	Pipe and Culvert Lengths	Number of Structures in System	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
-	Citywide (Sediment Basin)	Throughout its history, Seldovia has been used as a native village, fur trade, gold mining stop, commercial fishing, and logging location. The 1964 Earthquake caused substantial damage requiring the City to rebuild. Part of the rebuilding process included the Urban Renewal Project that significantly regraded the City and installed new stormwater infrastructure. Road and drainage projects and improvements occurred through the 1980's and 1990's. Now, the stormwater infrastructure is showing signs of aging. The stormwater system outfalls directly to Seldovia Slough or Seldovia Bay. Drainage improvements are proposed to mitigate non-source pollutions to downstream waterbodies.	1985	Needs Replacement - Low Priority	Medium	Based on the 2024 stormwater priority projects survey, this project was ranked 1st by public feedback. 2023 drainage survey public feedback suggested clearing out drains as soon as possible around town to help evacuate excess runoff. Another comment mentioned there have been sheens in the harbor because of oil in the storm drains or fuel tanks leaking into Seldovia Slough; and that some boats still pump their bilges in the harbor and that creates a sheen.	Community-Wide	Pipe Total: 2679.4 ft Culvert Total: 1311.2 ft	Pipe Total: 54 Culvert Total: 44 Catch Basin Total: 35 Manhole Total: 11 Outlet Total: 15	60	-Acquire a Street Sweeper- with Curb Brooms. -Acquire a Vacuum Truck- Super Sucker/Dry Vac with Jetter. -Perform more frequent and effective street sweeping.	-Sediment Basin Study: This project will further develop sediment basin design and implementation in key locations within the City to reduce the sediment load in stormwater flows being discharged to receiving waters. Suspended sediment in stormwater can result in undesirable water quality impacts such as increased turbidity and pollutants. Over time, sediment accumulation in the stormwater system can reduce system capacity and require additional maintenance. Initial suggestions include FKR, SPG, and WIN. -Citywide Regrading and Relocating Inlets: Recommends rehabilitating the drainage paths to existing stormwater inlets and, in some cases, relocating stormwater inlets to provide more effective roadway drainage. -Stormwater Manhole and Inlet Markers: Recommends replacing stormwater manhole covers and adding signage to stormwater inlet grates to alert and remind individuals that flows that enter the stormwater system flow directly to downstream waterbodies.	Yes
AIR	Seldovia Airport	The Seldovia Airport provides air transit for a community that relies on either air or water transportation. The airport is owned and maintained by DOT&PF and was last reconstructed in the mid-1980's. The airport and hillside are generally drained by cross drainage culverts located in airfield ditches. The outlets drain to Seldovia Slough and are tidally influenced. During the visual inspection, the roadway infrastructure was found to generally be in good condition. An Airport Improvement Project is proposed but the construction years have not been determined.	1985	Functioning	Low	-	Community-Wide	Pipe: 118.4 ft Culvert: 473.9 ft	2 Pipes 12 Culverts 1 Manhole	30	-	Support proposed Airport Improvement Project.	-
ALD	Alder Street	Alder Street consists of two segments, one is paved and the other is gravel. ALD curb and field inlets collect surface flow that feeds into the WIN and SEL systems. Some residential connections into the ALD system could not be traced back to their origins, so not all of the existing system was located during visual inspections. A 1984 preliminary plan set proposed stormwater improvements on Alder Street but visual inspections did not indicate the improvements were built.	1969	Needs Replacement - Low Priority	Low	-	Neighborhood	Pipe: 154 ft	3 Pipes 1 Manhole 2 Catch Basins	50	Routine street sweeping for paved portion.	-	-
AND	Anderson Way	Anderson Way is a gravel road that connects to Jakolof Bay. Visual inspections occurred along Anderson Way from Main Street to Shoreline Drive (city limits). AND consists of a curb inlet at Seldovia Street and driveway cross drainage culverts. Culverts were found to be partially to fully buried. Public feedback mentioned pooling at the junction of Anderson Way and Winifred Avenue.	1984	Needs Replacement - Low Priority	Low	Based on the 2024 stormwater priority projects survey, this project was ranked 3rd by public feedback. 2023 drainage survey public feedback mentioned the fire hydrant, on Anderson Way adjacent to the Hillt's property, gets plowed in. Another comment stated standing water has been seen in front of the Hillt's.	Neighborhood	Pipe: 13.3 ft Culvert: 74.1 ft	1 Pipe 2 Culverts 1 Catch Basin	40	-	Replace AND-P-002.	-

Stormwater System	Location	History						Existing System			Future Planning		
		History Summary	Year Constructed/ Substantially Modified	Visual Inspections Rating	Annual Cost Impact	Stormwater Public Feedback	Community Impact	Pipe and Culvert Lengths	Number of Structures in System	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
ARP	Airport Avenue	Airport Avenue connects Main Street to the Seldovia Airport and crosses the Seldovia Slough Bridge. From Main Street, Airport Avenue is paved until it transitions to gravel after ARP-P-006. Existing infrastructure consists of two piped systems for the Seldovia Slough Bridge, and curb inlets and a cross culvert located northeast of Frank Raby Drive. The Bridge has curb inlets located at both ends and deck drains along its length. ARP-P-005 is damaged underneath the road prism; this culvert may be replaced with the proposed Airport improvement project. Poor drainage occurs at ARP-S-004, ARP-S-006, and ARP-S-007 where the curb inlets are not located in the low spot. All outfall into Seldovia Slough. Public feedback provided the following feedback; surface runoff flows from streets near the Bridge have been seen with increased turbidity during rain events; ponding issues on the Bridge due to ice and slush clogging the deck drains; further ponding issues along the unpaved portion of Airport Ave. leading towards the airport. During visual inspection, surface flows from Kachemak Street and Augustine North Avenue may be contributing to increased turbidity.	1979	Needs Replacement - Low Priority	Medium	2023 drainage survey public feedback mentioned notable turbidity in the surface runoff near the bridge when it rains. Another comment stated standing water is an issue along the dirt road to the airport. Additionally, another public comment received mentioned that the bridge often clogs with slush and ice, causing ponding issues. During 2024 visual inspections, runoff from Kachemak Street or Airport Avenue was identified as a potential source of turbidity. The Seldovia Slough Bridge deck drains were also found to be clogged with sediment.	Community-Wide	Pipe: 48.4 ft Culvert: 30.2 ft	6 Pipes 1 Culvert 1 Manhole 4 Catch Basins 3 Outfalls	60	Routine street sweeping for paved portion.	-Include ARP-S-004 in Citywide Regrading and Relocating Inlets. -Replace ARP-P-005; coordinate with DOT&PF.	-
AST	A Street	A Street is a gravel road that provides private access beyond city limits and is not fully cleared based on its platting. Existing infrastructure conveys flow from the hillside to a ditch and then collects in a pond on east side of Augustine North Avenue. Only the cleared portion of A Street was investigated during visual inspections.	1983	Functioning	Low	-	Isolated	Culvert: 21.9 ft	2 Culverts	10	-	-	-
AUG	Augustine North Avenue	Augustine North Avenue is a gravel road. AUG generally provides east to west drainage. Public comment indicated that ponding was an issue for at least one home just south of the AUG-P-002 culvert. During visual inspections, AUG-P-001 appeared to drain a pond and was submerged at both ends. AUG-P-002 is a driveway culvert and conveys flow in a shallow ditch to DST.	1983	Functioning	Medium	Responses to the 2023 public survey from the property owners at 142 N Augustine Ave. indicate that there are ponding issues at the property. The same homeowners indicated that a culvert would solve these ponding issues.	Neighborhood	Culvert: 33.1 ft	2 Culverts	30	-	-	-
-	Bay Street	Bay Street transitions from a gravel road to the Historic Boardwalk. Surface flows were inspected and no existing stormwater infrastructure was located. A portion of Bay Street is built along a Bin-Wall (gravity retaining wall). The wall was constructed after the 1964 Earthquake. Public feedback expressed concern about drainage flows coming down from the hillside impacting residences on the Seldovia Slough side. Additionally, some roadway sediment appears to washed onto the boardwalk.	1965	Needs Replacement - Low Priority	Low	During 2023 visual inspections, property owners in area that expressed concerns with surface drainage impacting the Historic Boardwalk and their property (located on the Seldovia Slough side of Bay Street). Also expressed concerns with Bin-Wall (gravity retaining wall). Discussed potential solution of installation of a grate at edge of boardwalk and private deck.	Neighborhood	N/A	N/A	50	-	-	-
BLC	Bloch Street	Bloch Street turns into Spillum Street. The platted connection from Bloch Street to Anderson Way is currently a marshy walking path. BLC-P-001 provides cross drainage to the south, towards Lake Susan.	1991	Functioning	Low	A 2023 drainage survey response commented the right of ways on Fulmor and Bloch streets are generally being used for foot and bicycle transit by many.	Neighborhood	Culvert: 16.6 ft	1 Culvert	20	-	Add a swale along the north side of Bloch Street.	-
BST	B Street	B Street provides residential access. BST-P-001 is located on private property, provides cross drainage of flows from the hillside through a private gravel road, and outfalls to Seldovia Slough.	1983	Functioning	Low	-	Isolated	Culvert: 10.8 ft	1 Culvert	10	-	Obtain a drainage easement for drainage and stormwater infrastructure located on private property.	-
BYD	City Boat Yard, Main Street	The City boat yards are located at the northern end of Main Street. The drainage swales adjacent to the City boat yards are relatively flat and shallow. A piped system provides curb inlet drainage before outfalling to Seldovia Bay. Curbline sediment build up was seen during visual inspections. Public comment indicated that ponding and drainage issues are apparent in front of the City Boat Yard.	1984	Needs Replacement - Low Priority	Low	2023 drainage survey public feedback mentions pooling of water on the pavement and inadequate draining in front of the City's boat yard.	Community-Wide	Pipe: 152.7 ft	2 Pipes 2 Catch Basins 1 Outlet	50	-	-	-

Stormwater System	Location	History						Existing System			Future Planning		
		History Summary	Year Constructed/ Substantially Modified	Visual Inspections Rating	Annual Cost Impact	Stormwater Public Feedback	Community Impact	Pipe and Culvert Lengths	Number of Structures in System	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
CST	C Street	CST provides drainage through various cross culvert and ditches that generally drain toward the northwest and outfall to Seldovia Slough. Public comment indicated that maintenance and upgrades to the culverts in the system would be welcomed as a part of future drainage improvements. During visual inspections, the ditches were flowing water and meandered through private property. The condition of culverts varied from poor with corroded bottoms to good. Roadway rutting may indicate water overtops the roadway or pools. A 1991 drainage improvements plan set proposed stormwater improvements on C Street but visual inspections did not indicate the improvements were built.	1982	Needs Replacement - Low Priority	Low	Responses from the 2023 public survey regarding drainage issues in the city indicated that maintaining and updating the culverts on C St. would be a good project to help improve the City's stormwater system.	Neighborhood	Culvert: 141.7 ft	5 Culverts 1 Outlet	40	-	-Recommend obtaining drainage easements for drainage and stormwater infrastructure located on private property. -Replace cross-drainage driveway culverts CST-P-002 and CST-P-004.	-
DST	D Street	DST accepts flow from AUG to Seldovia Slough. During visual inspection, DST-S-002 was found to be corroded, crushed by riprap, and thought to be tidally impacted.	1982	Functioning	Low	-	Neighborhood	Pipe: 110.5 ft	2 Pipes 1 Manhole 1 Outfall	20	-	-	-
ENG	English Drive	English Drive is a gravel road that intersects with Main Street (paved) at English's western end. ENG provides conveyance for the west end of English Drive. Some of the existing infrastructure appears to date back to the late-1960's (Urban Renewal project) Based on available plan sets, additions and modifications occurred in the mid-1980's and early 1990's. Generally, flow enters the system through field and curb inlets and is piped to outfall into Seldovia Bay. Not all of the existing system was located during visual inspections.	1982	Needs Replacement - Low Priority	Low	-	Neighborhood	Pipe: 406.6 ft Culvert: 31.6 ft	6 Pipes 1 Culvert 1 Manhole 4 Catch Basins 1 Outfall	40	-	-	-
FKR	Frank Raby Drive	Frank Raby Drive is a gravel road with limited right of way. FKR accepts flow from RKY and consists of cross culverts and ditches flowing to the north. The west side of Frank Raby Drive has limited right-of-way and limited flow capacity. The cross culverts on this side are in poor condition and on private property. Public comments indicate prolonged pooling of water occurs in this area, with some areas specifically being impacted by damaged culverts. Ditch capacity is less constrained on the east side of the road and improves on both sides to the north where flow is conveyed across Airport Avenue. Culverts that cross Airport Avenue (FKR-P-003 and FKR-P-004) were noted to have sediment accumulation. Flow outfalls into Seldovia Slough. Not all of the existing system was located during visual inspections.	1991	Needs Replacement - High Priority	Medium	Responses from the 2023 public survey regarding drainage issues in the city indicated that the two culverts at the intersection of Frank Raby Dr. and Rocky St. are damaged and beyond their useful life, leading to ponding and drainage issues in adjacent lots. Responses also indicated that ponding remains in the area even 2 days after a rain event.	Neighborhood	Culvert: 195.5 ft	6 Culverts	70	-	Frank Raby Drive Drainage Improvements: This project will improve roadway drainage on Frank Raby Drive by installing new cross culverts; removing and replacing culverts FKR-P-001, FKR-P-002, and FKR-P-005; removing culvert RKY-P-001; and improving ditches. Flow down Rocky Street will be diverted down the east side of Frank Raby Drive after the removal of RKY-P-001 and installation of new culverts.	Yes
FUL	Fulmor Avenue, Alder Street, Main Street	Fulmor Avenue is partially undeveloped to the north and otherwise paved. FUL drains a portion of Alder Street, Fulmor Avenue, and Main Street to Seldovia Bay. Public comment indicated that ponding/drainage issues were reported near multiple residences along Fulmor Avenue. Visual inspections noted curblin sediment and water accumulation in the structure sumps. FUL-S-008 was found to be in poor condition with a corroded bottom. In 2023, FUL-P-003 was struck and repaired by construction in the area.	1976.5	Needs Replacement - Low Priority	Low	A 2023 drainage survey response commented the right of ways on Fulmor and Bloch streets are generally being used for foot and bicycle transit by many. Other comments mentions standing water in front of 260 Fulmor Avenue and drainage issues in front of 221 Fulmor Avenue.	Neighborhood	Pipe: 416.7 ft	7 Pipes 6 Catch Basins 1 Manhole 1 Outlet	40	Routine street sweeping.	-	-
HBR	Harborview Drive	Harborview Drive is paved and drained by HBR. HBR collects flow at curb inlets and outfalls to Seldovia Bay. Visual inspections noted sediment accumulation in curblines and HBR-S-003.	1984	Functioning	Low	-	Neighborhood	Pipe: 118.7 ft	2 Pipes 2 Catch Basins 1 Outlet	20	Routine street sweeping.	-	-
ILI	Iliamna Street	Iliamna provides drainage for a gravel lot and residences, located next to one of the City's boat launches. ILI outfalls to Seldovia Bay. The majority of the existing system was not located during visual inspections.	1983	Functioning	Low	-	Neighborhood	Pipe: 128 ft	2 Pipes 1 Catch Basin 1 Manhole 1 Outlet	20	-	-	-

Stormwater System	Location	History						Existing System			Future Planning		
		History Summary	Year Constructed/ Substantially Modified	Visual Inspections Rating	Annual Cost Impact	Stormwater Public Feedback	Community Impact	Pipe and Culvert Lengths	Number of Structures in System	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
KAK	Kachemak Street	Kachemak Street is a gravel road that has limited right-of-way and portions of steep grade. The southern end of Kachemak Street ties into Airport Avenue (paved). Surface flow from Kachemak Street and Willow Street flow toward the KAK system or directly into the Seldovia Slough. KAK consists of a field inlet in a small swale that outfalls to Seldovia Slough. Concerns with damaging private property during snow removal activities and melt off have been noted due to the limited right-of-way. Additionally, property owners along the Seldovia Slough side had expressed concerns about surface runoff and pooling. Not all of the existing system was located during visual inspections.	1993	Needs Replacement - High Priority	High	A 2023 public survey response mentioned snow melt has nowhere to drain to on Kachemak Street. Property owners at 234 Kachemak Street responded water from the road drains directly under their house causing concrete foundation settlement issues.	Neighborhood	Pipe: 35.5 ft	2 Pipes 1 Catch Basin 1 Manhole 1 Outlet	80	-	Kachemak Street Drainage Improvements: This project will improve roadway drainage and winter maintenance on Kachemak Street by installation of a new stormwater system and paved, inverted roadway crown.	Yes
LIP	Lipke Lane	Lipke Lane is a paved road with an inverted crown and center grate drain (LIP-S-002). During visual inspections, LIP-S-001 was found to be a vertical, perforated pipe without a visible outlet and LIP-S-002 was noted to have some vegetation growth. Not all of the existing system was located during visual inspections.	1984	Functioning	Low	-	Neighborhood	Pipe: 68.1 ft	2 Pipes 2 Catch Basins	20	Routine street sweeping.	-	-
LSU	Lake Susan, Lake Street, Kachemak Street	LSU provides an outlet for Lake Susan. During visual inspections, LSU-P-001 was found to have a rectangular weir in front of its inlet holding Lake Susan's water surface elevation. LSU-S-003 was heavily corroded and likely tidally impacted as it drains to Seldovia Slough. Not all of the existing system was located during visual inspections. Public comments and visual inspections note road rutting and pooling along Lake Street.	1992	Functioning	Low	Two responses from the 2023 public survey mention standing water and road rutting on Lake Street at the intersection of Kachemak Street.	Isolated	Pipe: 207 ft	3 Pipes 2 Manholes 1 Outlet	10	-	Add an additional inlet just west of the Lake Street and Shoreline Drive intersection and tie it into LSU.	-
MNS	Main Street	MNS provides drainage for a portion of Main Street (paved) and a City boat launch, located between Barnes Street and the City of Seldovia Central Park. During visual inspections, MNS-S-001 and MNS-S-003 were identified to not be in their respective low spots. Curbside sediment accumulation and rutting in the gravel parking lot were evident. This lot was noted to be used for snow storage. MNS-S-004 outfalls to Seldovia Bay and was corroded and horizontally smashed at the tide line. Public comment indicated ponding issues between the Main Street Garden and the Post Office, as well as near the boat ramp.	1983	Needs Replacement - High Priority	Medium	2023 drainage survey public feedback mentions pooling of water between the Main Street Garden and the PO. Another comment mentioned standing water at City lot near boat ramp, near harbor.	Community-Wide	Pipe: 113.8 ft	3 Pipes 3 Catch Basins 1 Outlet	80	Routine street sweeping.	Main Street Drainage Improvements: Facility #1: This project aims to improve surface drainage, filter pollutants, provide temporary storage of stormwater, and provide beautification through the implementation of a sediment basin along Main Street near the municipal boat launch. MNS-S-001 and MNS-P-001 are to be removed; MNS-S-002 is to be added; and MNS-P-002, MNS-S-003, MNS-P-003, and MNS-S-004 are to be removed and replaced.	Yes
PEN	Peninsula Street	PEN drains the intersection of Main Street and Airport Avenue. This area is paved and is adjacent to several gravel parking lots. PEN collects flow at curb inlets and that are not located in the low spots. Visual inspections noted sediment accumulation in curbsides and structure sumps. PEN-S-003 outfalls to Seldovia Bay but could not be located. Multiple responses to the public survey mentioned ponding issues near the intersection of Main Street and Airport Avenue.	1983	Needs Replacement - High Priority	Low	Four responses from the 2023 public survey mention standing water issues in front of the Gateway Pavilion and 198 Main Street.	Community-Wide	Pipe: 121.8 ft	2 Pipes 2 Catch Basins 1 Outlet	70	-	Main Street Drainage Improvements: Facility #2: This project aims to improve surface drainage, filter pollutants, provide temporary storage of stormwater, and provide beautification through the implementation of a sediment basin along Main Street at the Gateway Pavilion in addition to a new piped stormwater system.	Yes
RKY	Rocky Street	Rocky Street is a gravel road that provides access to the Rocky Ridge Landfill. Ditches along Rocky Street carry flow and collect sediment. During visual inspections, the RKY-P-001 was found to provide cross drainage and was 75% full of sediment. Public comments indicate prolonged pooling of water occurs in this area, with one area specifically impacted by damaged culverts. This ponding issue impacts access to multiple lots within the vicinity of Rocky Street. Visual inspections terminated on Rocky Street at city limits (at Frank Raby Drive).	1991	Needs Replacement - High Priority	Medium	Responses from the 2023 public survey regarding drainage issues in the city indicated that the two culverts at the intersection of Frank Raby Dr. and Rocky St. are damaged and beyond their useful life, leading to ponding and drainage issues in adjacent lots (Lot 7 specifically). Responses also indicated that ponding remains in the area even 2 days after a rain event. An additional comment stated that Lot 7 is inaccessible during rain events due to standing water.	Neighborhood	Culvert: 11.9 ft	1 Culvert	70	-	(See section for FKR.)	-

Stormwater System	Location	History						Existing System			Future Planning		
		History Summary	Year Constructed/ Substantially Modified	Visual Inspections Rating	Annual Cost Impact	Stormwater Public Feedback	Community Impact	Pipe and Culvert Lengths	Number of Structures in System	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
SEL	Seldovia Street, Main Street	Seldovia Street is paved. SEL collects flow from ALD, AND, LIP, and WIN systems, in addition to its own curb and field inlets. Public comment and visual inspections noted sediment accumulation in curblines that caused pooling of water, especially around the Post Office. SEL outfalls to Seldovia Bay.	1984	Needs Replacement - Low Priority	Low	Three responses from the 2023 public survey mention pooling and icing issues on Main Street, in front of the post office. Another comment mentioned the large pile of snow next to the fire hall obstructs the view for oncoming traffic at a right angle.	Community-Wide	Pipe: 334.8 ft	5 Pipes 4 Catch Basin 1 Manhole 1 Outlet	50	Routine street sweeping.	-	-
SHL	Shoreline Drive	Shoreline Drive is a gravel road that generally surface flows directly into the Seldovia Slough. SHL-P-001 provides drainage for a small swale and outlets through a retaining wall. During visual inspection, notches in the retaining wall were noted to allow for additional drainage; however, they appear to commonly fill with sediment. SHL P-002 provides cross drainage for a marsh and the culvert was in poor condition and likely tidally influenced. Road ruts along Shoreline Drive were also noted. Public comment indicated ponding issues and road rutting between Young and Bloch Street and runoff-driven erosion issues near the junction with Malcolm Street.	1983	Needs Replacement - Low Priority	Low	The 2023 drainage survey received one comment about road ruts near the bridge (north end of Shoreline Drive), one comment about surface flows down Malcom Street eroding the road because of inadequate ditches, five comments about pooling water and road ruts around 316 Shoreline Drive, and one comment about pooling water in front of 279 Shoreline Drive. Based on the 2024 stormwater priority projects survey, this project was ranked 2nd by public feedback.	Neighborhood	Culvert: 40.6 ft	2 Culverts	40	Routinely clean out drainage notches in retaining wall.	-Regrade road to drain towards SHL-P-001 and ditch. - Add cross-culvert drainage along Shoreline Drive between Malcom Street and Young Street. -Add a new swale along the north side of Malcom Street. -Replace SHL-P-002. Additional survey is required to determine if the pipe could be raised above tidal influence.	-
SPG	Spring Street	Spring Street is a gravel road with a ditch that parallels its northeast side. SPG collects surface flows from Main Street, Vista Avenue, and a private road to the north. The ditch was noted to be shallow and against bedrock. SPG-P-001 outlets to Inside Beach and is corroded on the bottom.	1991	Functioning	Low	-	Isolated	Culvert: 35.4 ft	1 Culvert	10	Routinely clean out ditch line.	-	-
SPU	Spruce Street	Spruce Street is a steep, gravel road. Its northern end surface flows to the north and collects in a small, shallow swale with flow from the southwest side of Spring Street. The swale is located in the southern corner of Spruce Street and Spring Street and has been noted to pool. Flow outfalls to Inside Beach and then out to Seldovia Bay. During visual inspections, SPU-P-001's inlet contained accumulated sediment and its outlet was submerged.	1991	Functioning	Low	2023 drainage survey public feedback mentioned concerns and high maintenance costs with septic system at 435 Spruce Street. This comment is not stormwater related but is included for documentation.	Isolated	Culvert: 31.8 ft	1 Culvert	10	-	-	-
VIS	Vista Avenue, Main Street	Vista Avenue is a steep, gravel road that drains open ditches. Surface flow from Susan B. English School lot drains across Vista Avenue and down its ditches. During field inspections, some of the surface flow appears to infiltrate into the ground on the hillside. During visual inspections, flow from VIS-P-001 was noted to have a large amount of orange flocculant which could indicate iron-rich groundwater. Additionally, corroded water lines along Vista Avenue were replaced in 2023, which is an issue unique to this area. VIS-P-002 provides drainage for a private road and is not located in the low spot. A shallow swale parallels the southeast City boat yard and directs flow to VIS-P-003. VIS-P-003 is damaged and has minimal cover over it. VIS outfalls to the ditch along Spring Street. Not all of the existing system was located during visual inspections. Public comment mentioned ice accumulation issues on Vista Avenue from creek drainage.	1983	Needs Replacement - Low Priority	High	2023 drainage survey public feedback mentions creek drainage causes ice on Vista Avenue.	Neighborhood	Pipe: 12.2 ft Culvert: 52.1 ft	1 Pipe 2 Culverts	60	-	-Obtain drainage easement for drainage and stormwater infrastructure located on private property. -Vista Avenue Drainage Improvements: This project aims to rehabilitate stormwater existing ditches and swales and remove and replace cross-drainage culvert VIS-P-002 along Vista Avenue to mitigate surface and groundwater flow impacts on residences and downstream infrastructure. In conjunction with a water quality study, it would attempt to mitigate the corrosion issues that have been occurring in this area.	Yes
WIL	Willards Way	Willards Way is a gravel road with a large ditch along its southeast side. WIL-P-001 is private cross drainage culvert that is maintained by the property owner. WIL feeds into CST.	1983	Functioning	Low	-	Isolated	Culvert: 35.1 ft	1 Culvert	10	-	-	-

Stormwater System	Location	History						Existing System			Future Planning		
		History Summary	Year Constructed/ Substantially Modified	Visual Inspections Rating	Annual Cost Impact	Stormwater Public Feedback	Community Impact	Pipe and Culvert Lengths	Number of Structures in System	Prioritization Total Score	O&M Recommendation(s)	Long-Term Recommendation(s)	2024 DIP
WIN	Winifred Avenue, Alder Street, Anderson Way	Winifred Avenue is a gravel road. WIN interacts with the ALD and SEL drainage systems and provides drainage for several roads. Flow generally surface flows or becomes ditched before entering a WIN field inlet or cross culvert. During visual inspections, the swales along the Susan B. English School lot were noted to be relatively flat and small. Public feedback mentioned pooling at the junction of Winifred Avenue and Anderson Way. Not all of the existing system was located during visual inspections. WIN-P-002 dates back to the early 1980's. Public comment mentions ponding issues near Susan B. English School as well as other nearby properties.	1983	Needs Replacement - Low Priority	Low	2023 drainage survey public feedback mentioned road ruts at the school and the Y below the school. Another comment mentioned standing water in front of the school. During 2023 visual inspections, 350 Winifred Avenue property owner expressed concerns with water pooling around their lot.	Community-Wide	Pipe: 118.9 ft Culvert: 56.5 ft	3 Pipes 2 Culverts 1 Catch Basin	50	-	-Re-establish drainage ditches along the front of the school. -Replace WIN-P-001. -Replace WIN-P-002; coordinate with DOT&PF.	-
WTR	Water Supply Road	Water Supply Road is a steep, gravel road that provides access to the Seldovia Water Treatment Plant (WTP). The WTP was constructed in 2017. During visual inspections, small ditches were seen intermittently along the road and flowing water was heard. Bedrock seepage from behind the WTP was suspected. One cross drainage pipe (WTR-P-001) was located. Flow appeared to infiltrate in the marsh area to the southeast of Seldovia Airport. In 2024, additional water flows had impacted the road due to water line breaks.	2017	Needs Replacement - Low Priority	High	-	Community-Wide	N/A	N/A	60	Routinely clean out ditch lines.	Add a new ditch from the North Rocky Ridge Trailhead to the water storage tank.	-
YNG	Young Street	Young Street is a gravel road that consists of two segments. From the west, flows generally surface flow. During visual inspection, only the crown of YNG-P-001 was seen and therefore the culvert is assumed to be blocked. YNG-P-002 provides cross drainage for a marshy area adjacent to Lake Susan. Public comment and visual inspections note consistent pooling of water in this area, thought to be due to the relatively flat topography. YNG-P-001 dates back to the early-1980's where YNG-P-002 is thought to be from the early-1990's.	1987	Functioning	Low	2023 public survey response indicated that the culvert on Young St. east of Anderson Way appeared to be "unmaintained, undersized, or failing". Another indicated that standing water has been seen.	Neighborhood	Culvert: 18.4 ft	1 Culvert	20	-	-Re-establish upstream and downstream ditch line. -Upsize and replace YNG-P-001.	-

Notes:
Visual Inspections Ratings are based on visual inspections conducted in September 2023 and August 2024 by HDR.
approx. = approximate/approximately; Alaska DOT&PF = Department of Transportation and Public Facilities; ft = foot/feet, NA = not applicable.

Stormwater System	Location	Average Age of Infrastructure		Visual Inspections Rating		Annual Cost Impact		Community Impact		Prioritization Total Score
		Age	Score	Rating	Score	Impact	Score	Impact	Score	
-	Citywide (Sediment Basin)	39	10	Needs Replacement - Low Priority	20	Medium	10	Community-Wide	20	60
AIR	Seldovia Airport	39	10	Functioning	0	Low	0	Community-Wide	20	30
ALD	Alder Street	55	20	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	50
AND	Anderson Way	40	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
ARP	Airport Avenue	45	10	Needs Replacement - Low Priority	20	Medium	10	Community-Wide	20	60
AST	A Street	41	10	Functioning	0	Low	0	Isolated	0	10
AUG	Augustine North Avenue	41	10	Functioning	0	Medium	10	Neighborhood	10	30
-	Bay Street	59	20	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	50
BLC	Bloch Street	33	10	Functioning	0	Low	0	Neighborhood	10	20
BST	B Street	41	10	Functioning	0	Low	0	Isolated	0	10
BYD	City Boat Yard, Main Street	40	10	Needs Replacement - Low Priority	20	Low	0	Community-Wide	20	50
CST	C Street	42	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
DST	D Street	42	10	Functioning	0	Low	0	Neighborhood	10	20
ENG	English Drive	42	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
FKR	Frank Raby Drive	33	10	Needs Replacement - High Priority	40	Medium	10	Neighborhood	10	70
FUL	Fulmor Avenue, Alder Street, Main Street	47.5	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
HBR	Harborview Drive	40	10	Functioning	0	Low	0	Neighborhood	10	20
ILI	Iliamna Street	41	10	Functioning	0	Low	0	Neighborhood	10	20
KAK	Kachemak Street	31	10	Needs Replacement - High Priority	40	High	20	Neighborhood	10	80
LIP	Lipke Lane	40	10	Functioning	0	Low	0	Neighborhood	10	20
LSU	Lake Susan, Lake Street, Kachemak Street	32	10	Functioning	0	Low	0	Isolated	0	10
MNS	Main Street	41	10	Needs Replacement - High Priority	40	Medium	10	Community-Wide	20	80
PEN	Peninsula Street	41	10	Needs Replacement - High Priority	40	Low	0	Community-Wide	20	70
RKY	Rocky Street	33	10	Needs Replacement - High Priority	40	Medium	10	Neighborhood	10	70
SEL	Seldovia Street, Main Street	40	10	Needs Replacement - Low Priority	20	Low	0	Community-Wide	20	50
SHL	Shoreline Drive	41	10	Needs Replacement - Low Priority	20	Low	0	Neighborhood	10	40
SPG	Spring Street	33	10	Functioning	0	Low	0	Isolated	0	10
SPU	Spruce Street	33	10	Functioning	0	Low	0	Isolated	0	10
VIS	Vista Avenue, Main Street	41	10	Needs Replacement - Low Priority	20	High	20	Neighborhood	10	60
WIL	Willards Way	41	10	Functioning	0	Low	0	Isolated	0	10
WIN	Winifred Avenue, Alder Street, Anderson Way	41	10	Needs Replacement - Low Priority	20	Low	0	Community-Wide	20	50
WTR	Water Supply Road	7	0	Needs Replacement - Low Priority	20	High	20	Community-Wide	20	60
YNG	Young Street	37	10	Functioning	0	Low	0	Neighborhood	10	20

Notes: Sorted by Stormwater System. Visual Inspections Ratings are based on visual inspections conducted in September 2023 and August 2024 by HDR.

Appendix E – Community Involvement Documents



2023 Community Involvement Documents



Seldovia Drainage Mapping & Stormwater
Management Plan Update
C/O HDR
582 E 36th Ave
Anchorage, AK 99503

***** NOTICE *****

City of Seldovia Drainage Mapping & Stormwater Management Plan

Survey Available

August 21, 2023 - September 29, 2023

**WE WANT
YOUR
FEEDBACK**

www.surveymonkey.com/r/Seldovia

City of Seldovia Drainage Mapping & Stormwater Management Plan

The goal of this project is for the City to develop a Stormwater Management Plan that provides a strategic roadmap tailored to our community's needs.

Your feedback will help make this plan successful!

We want your help identifying drainage and stormwater issues in the City of Seldovia. You are invited to participate in a survey as part of the creation of the City's Drainage Map and Stormwater Management Plan.



Scan Me

Drainage Mapping & Stormwater Management Plan
August 21, 2023 - September 29, 2023
www.surveymonkey.com/r/Seldovia



**Questions or
Comments?**

Phone: (907) 308-4130

Email: connect@SeldoviaStormwaterPlan.com

Respondent ID	Question				
	1	2	3	4	5
	Has a roadway near your property ever flooded due to rain?	Are there culverts in your area that appear to be unmaintained, undersized, or failing?	Does water continue to stand in roadside ditches, roadways, or other channels more than two days after a rain ends?	Has your property or roadway to your property been threatened by eroding creek banks or ditches?	Do you have any concerns with where snow is stored in the winter?
1	(Left Blank)	Under Young Street a few yards east of Anderson way	Along the east side of Anderson way, especially near Young St.	(Left Blank)	When it blocks driveway access
2	(Left Blank)	(Left Blank)	Creates many big potholes	(Left Blank)	(Left Blank)
3	less than once a year	(Left Blank)	Fulmore Ave in front of Stephanie's Radzy's Custer's A frame house	(Left Blank)	(Left Blank)
4	No ditches so the water just runs down the road	There are not enough culverts. The ditches are not maintained or even there	It creates Chuck holes that come back even after the road is graded because they are deep. Look by the school or by Bev Hecks' or shoreline drive towards the bridge or right at the Y below the school	Malcom street has a ditch issue. The water running down the road has created its own ditch in the road	The city is not supposed to be pushing snow into the bay, slough or harbor because of possible contaminants. The snow should be in piles and let melt in the spring
5	Quite often	At the corner	Low spots of our property drain poorly and are often swamping us	(Left Blank)	Snow removed from roadways is stored on our property and often pushed well beyond easement limits.
6	(Left Blank)	On Shoreline between Bev Hecks and Ed Packer's.	Rain stands between Bev Hecks' and Ed Packer's, in front of Laurel Hilts's, and in front of Stan Coleman's. In front of Perley Morrison's and Jared Patterson's. In front of Craig Barnard's. Adjacent to the school ball field. Along the dirt road from Perley's to Inside Beach. All along the dirt road to the airport.	(Left Blank)	The State plows in the fire hydrant on Anderson Way adjacent to the Hilts's property. The large pile of snow next to the fire hall obstructed the view for oncoming traffic at a right angle. Don't know that street name. The one that borders the multipurpose building.
7	Every heavy rain	(Left Blank)	Halfway down Shoreline Drive	(Left Blank)	Please don't pile it up in someone's yard without their okay
8	Everytime we have a hard or constant rain.	(Left Blank)	On Kachemak St. directly behind our house. It accumulates coming down the road and drains directly under our house. It has caused the street side of the house. It has undermined the concrete our house is sitting on and is causing our house to settle severe enough that the front of the house is no longer resting firmly on the posts the support the beam that runs along the front of the house.	Undermining our foundation enough when you are inside the house the slant at the back of the house is extremely noticeable.	The city is no longer using our property for a snow dump like they used too.

Respondent ID	Question				
	1	2	3	4	5
	Has a roadway near your property ever flooded due to rain?	Are there culverts in your area that appear to be unmaintained, undersized, or failing?	Does water continue to stand in roadside ditches, roadways, or other channels more than two days after a rain ends?	Has your property or roadway to your property been threatened by eroding creek banks or ditches?	Do you have any concerns with where snow is stored in the winter?
9	Everytime there is rain.	Rocky Street and Frank Raby intersection. Both culverts are damaged and beyond useful life and drain onto Lot 7 causing flooding and reducing property value.	Rocky Street. Cannot access Lot 7 when raining.	The city has created a ditch within my Lot 7 property boundaries.	Snow is pushed into Seldovia Slough and Bay causing turbidity in waters of United States.
10	(Left Blank)	(Left Blank)	Near the pavilion	(Left Blank)	(Left Blank)
11	(Left Blank)	(Left Blank)	142 N Augustine	(Left Blank)	(Left Blank)
12	(Left Blank)	(Left Blank)	During spring snow melt time, it doesn't impact me	(Left Blank)	(Left Blank)
13	Every time it rains or the snow melts there is standing water in front of my house, there are always huge deep puddles near the pavilion	The one drain near the pavilion is to far uphill so there is constantly standing water at that intersection.	On main Street by the pavilion and in front of 142 N Augustine.	(Left Blank)	(Left Blank)

Respondent ID	Question				
	6	7	8	9	10
	Do you have any issues with spring drainage from snow storage?	In the last five years has the water quality of stormwater runoff gotten worse?	Are there other drainage issues, within the city limits, that you would like the city to be aware of?	Do you think there are any projects or programs that would help improve the stormwater system for the city?	Do you have any other stormwater or drainage concerns that you wish to share?
1	(Left Blank)	(Left Blank)	The “storm drains” on both sides of the street by the post office seem to easily plug and ‘create’ a temporary ‘lake’ from time to time. Also, Shoreline in the Bloch and Young vicinity can retain water on the roadway from melt and rain.	(Left Blank)	The right of ways not being used for vehicle ways on Fulmore and Bloch streets are being used for foot and bicycle transit by many in this area, not only the young bike riders, but also adults, including seniors. Especially on the Fulmore section between the picnic gazebo and the Hilt’s property, the walkway is getting churned into a muddy mass by the youths riding the bicycles instead of walking them. It is safer for the youths and for the seniors of the area to walk these paths as opposed to walking on the edge of Andersen Way.
2	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)
3	(Left Blank)	(Left Blank)	sewer very slow drain along Anderson Way St	The main intersection by post office often clogs with slush/ice. Big puddle forms. Same on the bridge.	(Left Blank)
4	The snow melting from storage piles doesn’t create an issue	There have been sheens in the harbor because of oil in the storm drains or fuel tanks leaking in the slough. Some boats still pump their bilges in the harbor and create a sheen	There are contaminated lands within city limits that need attention. ADEC could come in and inspect these lands and properties	(Left Blank)	It is an aging infrastructure and will need to have culverts and sewer system replaced. Look at the lift stations
5	Compacted snow and debris remains on our property months after other snow has melted.	(Left Blank)	(Left Blank)	Maintaining and updating culverts on c street and other streets.	(Left Blank)

Respondent ID	Question				
	6	7	8	9	10
	Do you have any issues with spring drainage from snow storage?	In the last five years has the water quality of stormwater runoff gotten worse?	Are there other drainage issues, within the city limits, that you would like the city to be aware of?	Do you think there are any projects or programs that would help improve the stormwater system for the city?	Do you have any other stormwater or drainage concerns that you wish to share?
6	There is no where for the moisture to go along Kachemak Drive. It would help if some type of drainage function existed there. The moisture has no where to go. Clearing out drains as soon as possible around town would certainly help evacuate the excess runoff. A fair amount pools in front of the Mad Fish, and between the Main Street Garden and the PO. And of course along the boatyard on the pavement. That area is terrible for draining. Also on the main corner across from the liquor store.	This question implies we are judging the water quality? Perhaps we're judging the quantity? I think the water buildup down by the boatyard is better than it has been.	Creek drainage on Vista creates a very icy situation. The drainage at the intersection of Kachemak and Shoreline creates quite a bit of water buildup.	(Left Blank)	"stormwater" Developing the crown on the roads should be made a high priority. Well beyond expending dollars to put in a walking boardwalk along the harbor. We have so many elders walking and traversing the streets and they should be kept safe.
7	(Left Blank)	(Left Blank)	(Left Blank)	I don't know nearly enough about this topic to suggest a project	(Left Blank)
8	(Left Blank)	It's never been addressed especially after they decided to raise Kachemak Street.	(Left Blank)	How about a catch basin that'll divert water out to the slough without eroding the bank or grade the road so the water is on the other side so it goes to the catch basin further down however I feel that would only be a short term solution because it would need constant upkeep and they can't even fix potholes.	Just the damage being done to our property. Pretty bad when we have go and shore up the side of the road ourselves to keep the water from running under our foundation. Not easy.
9	Floods access to my property.	The City of Seldovia does not perform infrastructure maintenance.	The street drainage by slough bridge causes turbidity when it rains.	Entire gravel road system needs to be raised, ditched and install proper culverts.	There are temporary ways to grade roads to make water flow until roads can be raised. Hire a decent grader operator.
10	(Left Blank)	(Left Blank)	City lot near boat ramp near harbor, standing water.	I am not sure what programs are available to keep our slough, harbor and bay protected from contamination.	(Left Blank)
11	(Left Blank)	Just this year my property has been almost completely covered in water	I desperately need a culvert from my property, it could easily cross under the road and drain straight into the slough. Please let me know if is a possibility!	Yes putting in a culvert will greatly improve my property thank you!!!!	Yes my property really needs that culvert!!!

Respondent ID	Question				
	6	7	8	9	10
	Do you have any issues with spring drainage from snow storage?	In the last five years has the water quality of stormwater runoff gotten worse?	Are there other drainage issues, within the city limits, that you would like the city to be aware of?	Do you think there are any projects or programs that would help improve the stormwater system for the city?	Do you have any other stormwater or drainage concerns that you wish to share?
12	(Left Blank)	(Left Blank)	(Left Blank)	Hopefully it's not going to water treatment plant, if so that should stop	(Left Blank)
13	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)	(Left Blank)

Meeting Minutes

Date:	Tuesday, November 07, 2023
Time:	1:00 PM – 2:00 PM
Location:	Online Teams meeting
Project:	Seldovia Stormwater Mgmt Plan
Prepared By:	Kacy Grundhauser, HDR
Subject:	Stakeholder Meeting – Seldovia Village Tribe (SVT)

1. Introductions

Entity	Team Member Name	Task Assignment	Phone	Email
SVT	Crystal Collier	President/CEO		
Seldovia	Heidi Geagel	City Manager		
HDR	Bill Spencer, PE	Senior Engineer		
HDR	Kacy Grundhauser, EIT	Deputy Project Manager		

2. Topics

Discussed a few locations in town that influence SVT directly or that Crystal has seen change over her life. Six locations were discussed and are shown below (these are also recorded in our GIS Stakeholder points.) The purple arrow indicates SVT's administration building.



- SVT is building a new clinic on Fulmore Ave. Fall 2023 construction hit the stormwater pipe that goes through that property, well within the property line. (Bill and Kacy were actually in the field right after this happened and talked to construction about this.) Crystal



mentioned it will be nice to know where the drainage system is so something like this can be avoided in the future.

b. Curb Inlets

- i. Airport Ave. curb inlets work well, near the parking lot of the administrative building. There is pooling near the pavilion, also mentioned by other community members and investigated while on site. The City has this location marked for a CIP next year and is interested in what HDR's recommendation is. The City is planning to put more inlets/ drainage infrastructure in. (Bill and I thought the inlets did not appear to be in the low spot of the road, therefore were not draining the area well.)
- ii. Fulmore Ave. curb inlets do not work well. There are pools around them and around the inlet across the Main St.
- iii. Seldovia St. inlets have pooling near them, also mentioned by other community members and investigated while on site.
- iv. Main St. curve drainage has pooling near the inlet, also mentioned by other community members and investigated while on site. This inlet does not appear to be in the low spot of the road and Bill mentioned it was weird to have an inlet in the inside of a curve.

c. Lake Susan water surface elevation discussion.

Crystal mentioned she has seen the lake water surface elevation lower over her life, increase in lily pad growth, and decrease recreation potential. Homeowners around the lake have drier backyards but the vegetation/trees now obstruct their view of the lake. Crystal questioned how the Lake outlet elevation was determined and if it should be raised. Bill mentioned the Lake has a weir in the stormwater infrastructure. A picture of the inlet (water from the lake) was viewed and the rust line on the pipe was much higher than the level seen during the site visit. Heidi mentioned that the Lake has been a point of discussion for the community. The operators do monitor the Lake and weir. Discussions of dredging the lake (no natural outlet for sediment) or removing the lily pads have been discussed. It could be a part of the life cycle of the Lake but could also be due to the man made outlet. Crystal would like to see a recommendation for a further study for the Lake be added. Bill mentioned we can add it as a recommendation but our work alone will not provide a solution.

d. Snow disposal.

Crystal mentioned she thought it was likely the biggest source of water contamination. Both Crystal and Heidi noted the high expensive of snow removal and how their scale of community does not have the resources to haul snow. Heidi mentioned she would be interested to see how much space the City needs for snow removal and if that needed space could be divided into various sites around town. Crystal mentions snow removal activities are conducted by SVT, SOA, and the City of Seldovia.

3. Action Items

Action Item	Lead Person/Entity	Due Date
Provide meeting minutes.	Kacy / HDR	
Determine if Zoom can be used instead of other platforms for online meetings.	Kacy / HDR	

Meeting Minutes

Date: Friday, December 15, 2023

Time: 10:30 AM – 11:30 AM

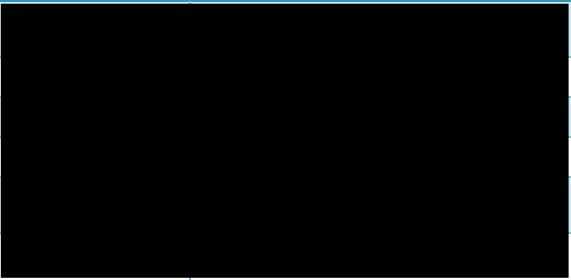
Location: Online Teams meeting

Project: Seldovia Stormwater Management Plan

Prepared By: Alice Horazdovsky, HDR

Subject: **Stakeholder Meeting – Department of Transportation and Public Facilities (DOT&PF)**

Introductions

Entity	Team Member Name	Task Assignment	Phone	Email
DOT&PF	Tyler Tucker	Lead Equipment Operator		
Seldovia	Heidi Geagel	City Manager		
Seldovia	Jan Yaeger	City Finance Officer		
HDR	Irene Turletes, PE	Project Manager		
HDR	Kacy Grundhauser, EIT	Deputy Project Manager		
HDR	Alice Horazdovsky	Public Involvement Coordinator		

Topics

- a) Project intro
 - i) HDR's role in the project is to support the City of Seldovia by putting together a Drainage Mapping and Stormwater Management Plan. The plan will provide the city with a strategic roadmap of potential drainage projects that are tailored to community's needs. The city is conducting outreach with community members via an online survey, and agencies via individual stakeholder meetings, to collect feedback on their needs. The team is currently about 6 months in to a 2-year project.
 - ii) HDR was in Seldovia earlier this year for a week collecting onsite data.
 - iii) During this meeting we hope to learn more about DOT&PF's needs and upcoming projects.
 - iv) Tyler noted that he saw the HDR team this summer and asked when they plan on coming back. Kacy responded that they plan to be back during the summer of 2024. During this year's trip they mapped all existing systems that they could find. She then shared the map of the collected data with meeting attendees.
- b) Storm Water Flooding
 - i) Tyler noted that the airport is his main area of concern since he is currently taking care of it. A resurfacing project is in progress which will replace culverts on airport property.
 - ii) Fish Creek Culvert
 - (1) Tyler added that heavy flows occur during significant rainfall along with the tidal influence. The overflow is close to the road surface, which is concerning. The riprap is in good condition/size so the road most likely won't blow out.
 - iii) Main Street Culverts
 - (1) Tyler asked what data the HDR team collected on Main Street's catch basin and culverts. In the past, DOT&PF would add calcium chloride and salt to prevent freezing throughout the winter.

- (2) Kacy responded that overall, the system is old. The condition of the pipes ranges from average to poor. Some pipes outfalls are corroded out or have catch basins with a buildup of sediment.
 - (3) At the end of Main Street, they were unable to find an outlet to one of the catch basins. The city and homeowners in that area noted that it drained okay but the inlet isn't in the low spot.
- iv) Fulmore Avenue
 - (1) Kacy panned the map to show the 3 catch basins in this area. She mentioned that during field investigations, the bottom of the outlet pipe was found corroded and an upstream pipe of this system was hit by construction earlier in the year.
- v) Harbor View
 - (1) In this location 2 catch basins drain into the harbor.
- vi) Lipke Lane
 - (1) The road is inverted. The catch basin is in the center of the road` and connects to the Seldovia Street.
 - (2) Tyler commented that Seldovia Street and Main Street are notorious for puddling and freezing.
- vii) Main Street Catch Basin
 - (1) Tyler reiterated that puddling and freezing often occur here.
 - (2) Kacy commented that the parking lot has poor drainage. The manholes didn't look too bad although there was some accumulation of sediment.
 - (3) Tyler informed HDR that about 8 years ago, before he started, DOT&PF cleaned out all manholes on paved roads. He added that seeing the project data map is very cool as he can see how all the pieces of the system are connected.
 - (4) Kacy asked Tyler if he has noticed any issues on English Drive. Tyler responded that he hasn't noticed any issues on English Drive.
 - (5) Heidi asked Tyler who is responsible for the drainage along Main Street.
 - (a) Tyler responded that he was unsure. The surface of: Main, Dock, Anderson, Seldovia, and Airport are DOT&PF's responsibility, but he does not know who is responsible for the drainage.
 - (b) Heidi added that she inquired because she wants to know if and how to work with DOT&PF on the results of this Plan.
 - (c) Tyler responded that he definitely wants to be involved, but it would likely be above him. He asked Heidi to send him an email and he will forward it to Sean Montgomery, the M&O Superintendent.
 - (d) Heidi asked Kacy, when they were collecting data onsite, did they evaluate drainage on Water Street and Vista Avenue since this was brought up by the Public Works Operator.
- viii) Vista Avenue
 - (1) Kacy noted that the north side of school drains here. There is a small stream between the properties and a pipe that goes under the walkway.
 - (2) Heidi commented that there is lots of runoff in this area and is concerned about corrosion.
 - (3) Kacy let Heidi know that the property owners said the same thing and that the flow is high even in dry weather conditions.
 - (4) Heidi hopes that the plan will have a suggestion to address this issue.
- ix) Water Supply Road
 - (1) Kacy noted that they still need to delineate the basin for Water Supply Road (outside of City limits). They only drove this road and did not get out to walk and look for culverts. The road is steep and, on a hillside, so runoff from the hill flows onto the road.

- (2) Heidi asked HDR to include this area in the Plan.
- (3) Tyler added that the puddling is bad in this area, especially at intersection with the Airport. Puddling will often occur in the middle of the road.
- (4) Also, on Airport Avenue, where the pavement ends and gravel starts, two culverts are collapsed. These are planned to be replaced by DOT&PF in the current resurfacing project. He requested for DOT&PF to repave to the airport but there is no guarantee that this will happen. Heidi agreed that paving that road, especially if it included the sidewalks, would be great. Tyler noted that at the top of the hill the ditches are filled with solid rock/shale. Hopefully these issues will be included in the DOT&PF project being designed by R&M.
- (5) Irene inquired if all culverts on the way out to the airport will be replaced.
 - (a) Tyler responded that just this culvert will be replaced since it's collapsed. All others are in good condition although the inlet pans may be replaced.
 - (b) The airport taxiway culverts will be replaced, and the hanger lots and airport parking will be reshuffled. It was noted that this project is currently in design and construction is anticipated to start in 1 to 2 years.
- c) Snow Storage
 - i) Tyler commented the everything in the apron goes into the center drainage ditches and melts out into the culverts. Half the runway drain to infield ditches and the other half drains to the slough.
 - ii) The ditches along the roadsides are used to for snow storage/stacking.
 - iii) Unlike DOT&PF, the city must carry some of its snow to where it can be stored/drained.
 - iv) Tyler added that DOT&PF has a MOU with the City for Main, Dock, Seldovia and Anderson Streets where the city plows and DOT&PF sands. DOT&PF plows the airport to where the pavement ends and out Jakolof Bay Road.
 - v) Tyler added that he tries not to use calcium chloride when he sands the road because of how corrosive it is. If needed he'll use a 50lb bag of salt or calcium chloride.
 - vi) Irene inquired if he hooks to the Seldovia Road thaw pipe. Tyler responded that he has not and was not aware that a thaw pipe existed there. Tyler commented that the city has a portable welder that can be used but they don't have -proper thaw pipe equipment.
- d) Other concerns that relate to Seldovia's drainage and stormwater management.
 - i) Tyler commented that this summer the pavement was fixed by crack sealing. He will also nominate the ditch work on Jakolof Bay Road to take place.
 - ii) If DOT&PF does anything with the culverts during the airport project, then ditching will be involved. He added that it will be nice to have new culverts in that area.
 - iii) Irene added that the Plan may include recommendation for repaving Main Street, Seldovia Street, Dock Street, and Airport Avenue. They will add the planned DOT&PF work into the document since the goal is to help the city prioritize projects and organize grant funding.
- e) Action Item
 - i) Irene will send contact info w meeting minutes
 - ii) Kacy noted that HDR will be back next summer to talk with the city and look at improvement spots. When they are in Seldovia she will set up a time to meet Tyler in person.



2024 Community Involvement Documents



Seldovia Stormwater Management Plan Update
C/O HDR
582 E 36th Ave
Anchorage, AK 99503

***** NOTICE *****

City of Seldovia Stormwater Management Plan Update

Survey Available

August 1, 2024 - September 6, 2024

**WE WANT
YOUR
FEEDBACK**

www.surveymonkey.com/r/SeldoviaSurvey

City of Seldovia

Stormwater Management Plan Update

The goal of this project is for the City to develop a Stormwater Management Plan that provides a strategic roadmap tailored to our community's needs.

We need your feedback to help make this plan successful!

You are invited to participate in a survey as part of the creation of the City's Stormwater Management Plan. **We want your help determining how the individual projects should be prioritized in the plan.**



Scan Me

Stormwater Management Plan: Project Prioritization

August 1, 2024 - September 6, 2024

www.surveymonkey.com/r/SeldoviaSurvey



**Questions or
Comments?**

Irene Turletes, HDR Project Manager

Phone: (907) 644-2099

Email: connect@SeldoviaStormwaterPlan.com

Visit www.cityofseldovia.com/stormwaterplan for more information on the status of the Plan.



Seldovia Stormwater Management Plan

City Council Work Session: Discussing Priority Stormwater Projects

August 26, 2024

Presenter: Irene Turletes, PE, HDR

In 2023, HDR focused on identifying drainage issues and concerns and mapping the existing stormwater infrastructure, summarized in a memo, available on the City's website (<https://www.cityofseldovia.com/stormwaterplan>).

This year, in 2024, we are gathering community input on prioritizing drainage projects, to develop a total of 5 conceptual level designs, to be included in the Stormwater Management Plan. All the projects will be included in the management plan, but the 5 determined to be the highest priority will include more detail to assist with planning and grant applications. During the work session we are going to briefly summarize last year's efforts, introduce this year's focus and walk through the list of identified recommended projects below.

Five projects will be prioritized for conceptual level design in the upcoming Plan, three of which the City has already identified. Those three are:

- **Vista Avenue Drainage:** Conduct further analysis and an improved grading and ditch conceptual design to improve surface drainage along Vista Avenue. Determining the source of the corrosion would not be investigated as it falls outside of the scope of this project/grant.
- **Main Street Drainage:** Conduct further analysis and conceptual design(s) to improve grading along curbs, to field inlets, and minimize ponding to improve surface drainage along Main Street. Snow storage locations would also be included in analysis.
- **Kachemak Street Drainage:** Conduct further analysis and develop conceptual designs to improve drainage for roadway and adjacent right-of-way.

There are nine other projects that were included as potential priority projects. After the survey, the City will use the results to help select the last two for the five priority projects that will include conceptual design development in the Management Plan.

- **City-wide Sediment Basin Study:** Effort would serve to review options to settle out sediment in stormwater before it is discharged to downstream waterbodies. Conduct desktop investigation of potential sediment basin locations with conceptual designs. Snow storage locations would also be included in analysis.



- **Bay Street Drainage:** Conduct further analysis of watershed, determination of drainage paths, and development conceptual drainage design(s) to improved surface drainage along Bay Street.
- **Winifred Avenue Drainage:** Conduct further analysis and develop conceptual designs to improve drainage for roadway and adjacent right-of-way.
- **Anderson Way Drainage:** Conduct further analysis and develop conceptual designs to improve drainage for roadway and adjacent right-of-way.
- **Shoreline Drive Drainage:** Conduct further analysis and develop conceptual designs to improve drainage for roadway and adjacent right-of-way.
- **Slough Bridge Drainage:** Conduct further analysis and develop conceptual designs to improve drainage for roadway and adjacent right-of-way.
- **Lake Susan:** Determining the lifecycle of Lake Susan would not be investigated as it falls outside of the scope of this project/grant. Previous lake studies should be referenced. Conduct analysis and conceptual design of retrofitting existing infrastructure to modify the lake's water surface elevation.
- **Frank Raby Drive Drainage:** Conduct further analysis and conceptual grading/ditch designs to improve surface drainage along Frank Raby Drive.
- **Water Supply Road Drainage:** Conduct further investigation of watershed and drainage patterns to improve drainage and minimize roadway erosion. Develop conceptual designs of improved stormwater conveyance.

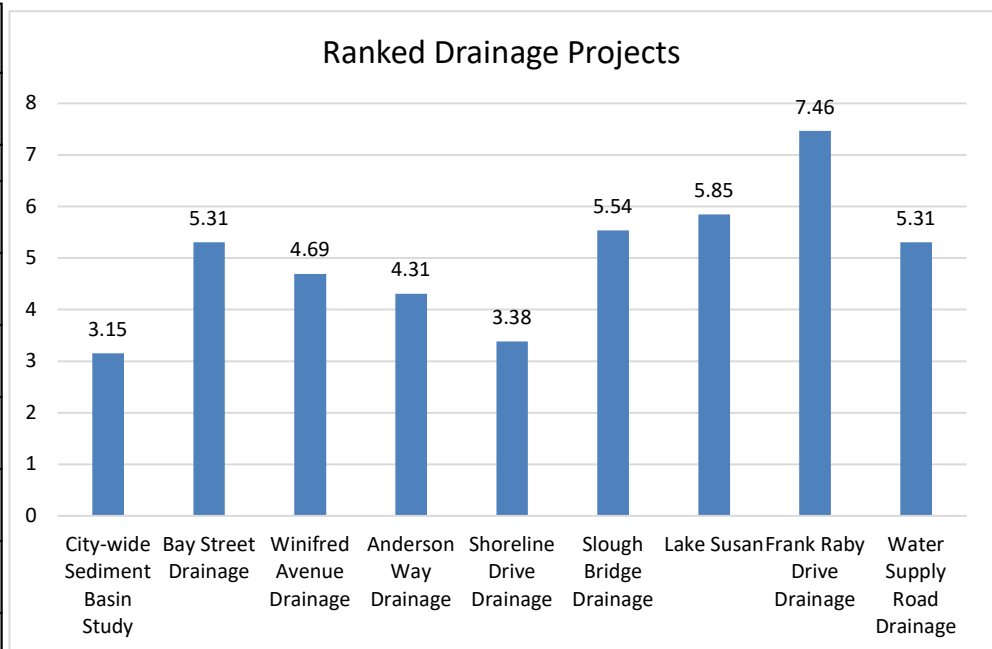
Please visit the community survey at <https://www.surveymonkey.com/r/SeldoviaSurvey> to help determine the last two priority projects. The survey will be open through September 6th.

Thank you again for being here as your feedback helps guide stormwater improvements in Seldovia.

Question: Rank the nine projects listed above. Place the most important to you at the top of the list and the least important at the bottom.

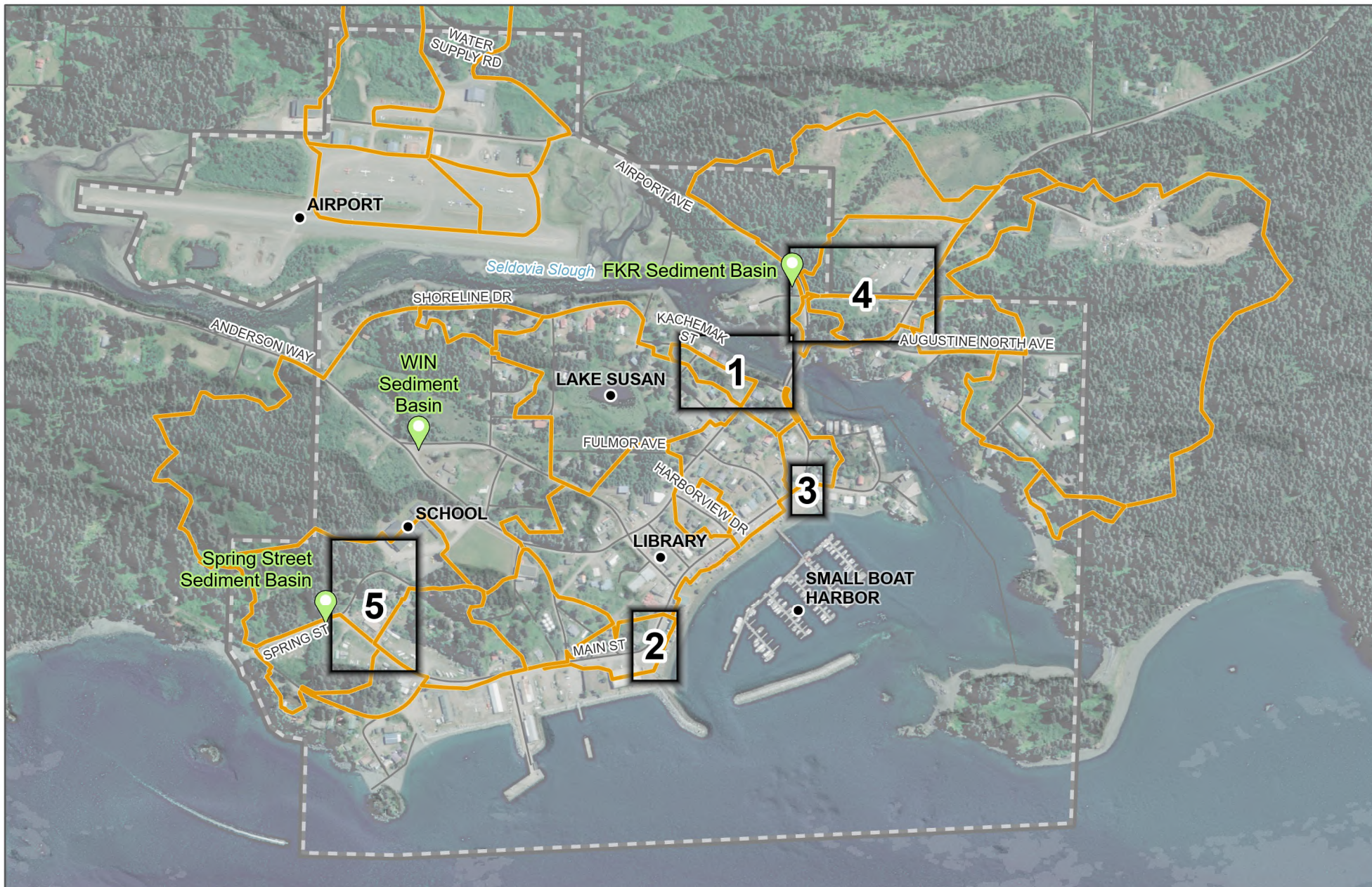
Respondent ID	City-wide Sediment Basin Study	Bay Street Drainage	Winifred Avenue Drainage	Anderson Way Drainage	Shoreline Drive Drainage	Slough Bridge Drainage	Lake Susan	Frank Raby Drive Drainage	Water Supply Road Drainage
1	5	8	1	4	2	6	9	7	3
2	1	7	6	2	3	4	9	8	5
3	1	2	8	9	5	6	4	7	3
4	4	7	5	3	1	2	8	6	9
5	2	8	6	5	1	4	3	9	7
6	5	6	3	4	2	7	8	9	1
7	1	5	3	7	6	4	2	9	8
8	1	2	3	5	4	7	6	9	8
9	4	5	6	3	2	1	9	7	8
10	1	2	3	4	5	6	7	8	9
11	4	5	6	2	7	8	3	9	1
12	3	6	7	5	4	9	1	8	2
13	9	6	4	3	2	8	7	1	5
Average	3.15	5.31	4.69	4.31	3.38	5.54	5.85	7.46	5.31

Proposed Drainage Projects	Community Score
Frank Raby Drive Drainage	7.46
Lake Susan	5.85
Slough Bridge Drainage	5.54
Bay Street Drainage	5.31
Water Supply Road Drainage	5.31
Winifred Avenue Drainage	4.69
Anderson Way Drainage	4.31
Shoreline Drive Drainage	3.38
City-wide Sediment Basin Study	3.15





Appendix F – Drainage Improvement Project (DIP) Maps



LEGEND

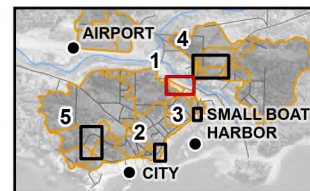
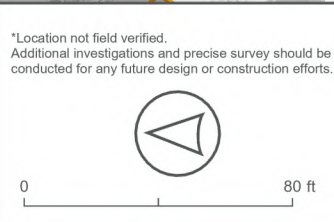
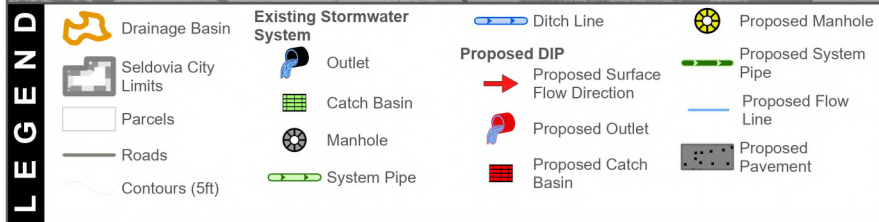
- Seldovia Facilities
- ▬ Seldovia City Limits
- Roads
- Drainage Basin
- Proposed Sediment Basin Location
- Map Series Page

0 1,000 ft

SEWARD
HOMER
SELDOVIA

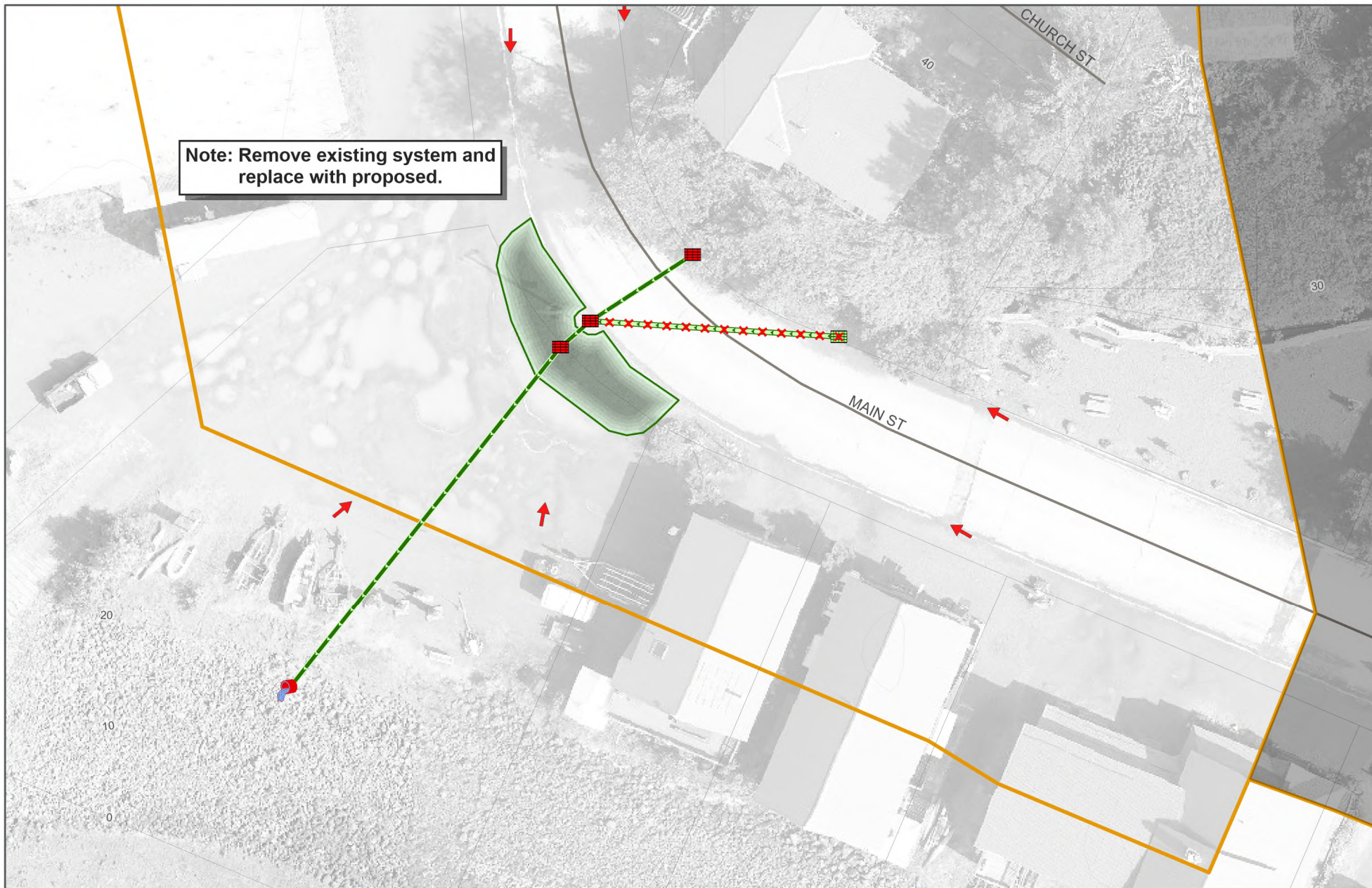
**SELDOVIA STORMWATER
MANAGEMENT PLAN:
DRAINAGE IMPROVEMENT
PROJECTS (DIPS)**

Overview
2/20/2025



SELDOVIA STORMWATER
MANAGEMENT PLAN:
DRAINAGE IMPROVEMENT
PROJECTS (DIPS)
KACHEMAK ST (KAK)
Figure 1
2/20/2025





Note: Remove existing system and replace with proposed.

LEGEND

- Drainage Basin
- Seldovia City Limits
- Parcels
- Roads
- Contours (5ft)

Existing Stormwater System

- Outlet
- Catch Basin
- System Pipe

Proposed DIP

- Proposed Surface Flow Direction
- Proposed Outlet
- Proposed Catch Basin

Proposed DIP

- Proposed System Pipe
- Proposed Removal
- Potential Sediment Basin

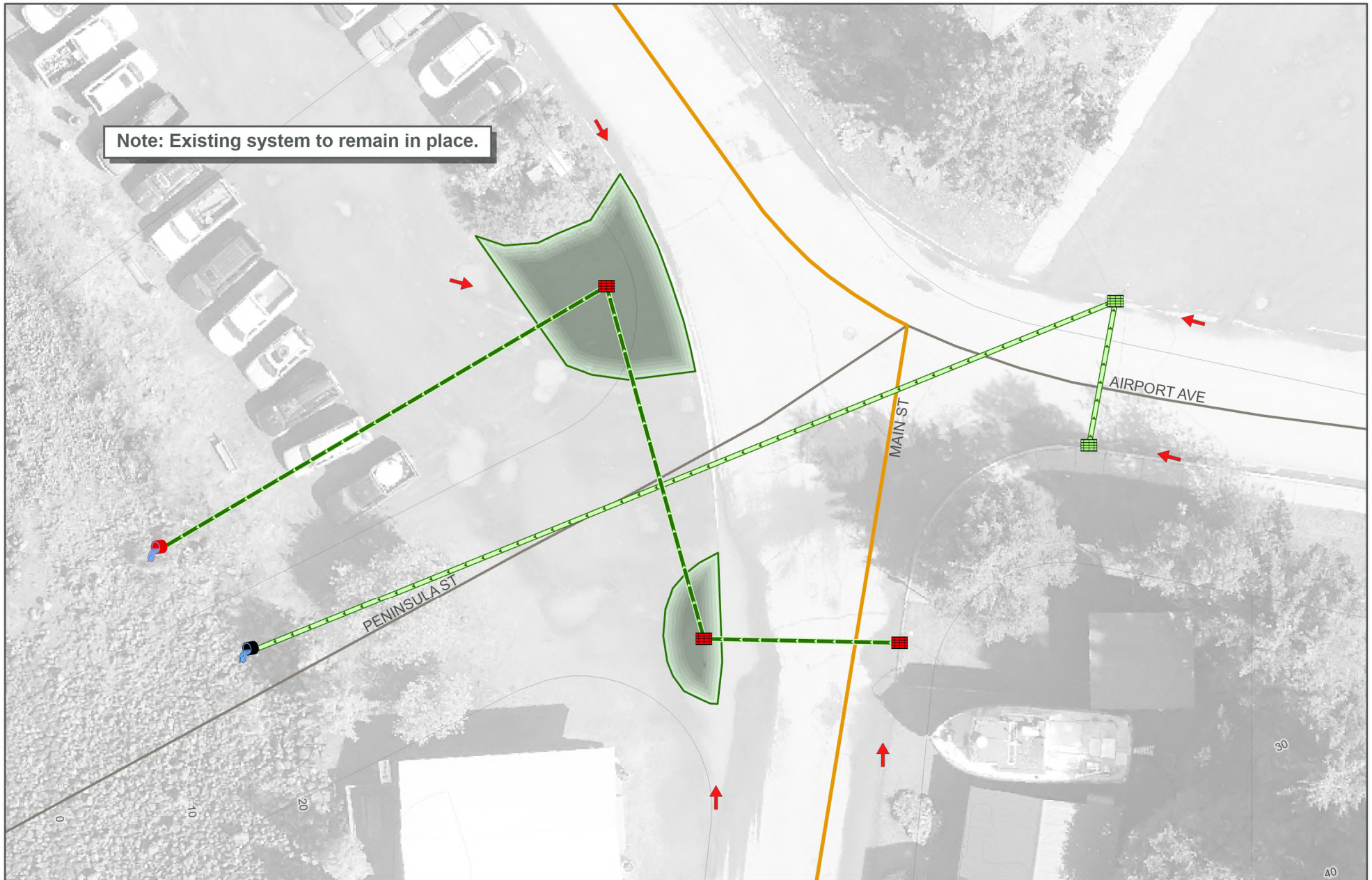
*Location not field verified. Additional investigations and precise survey should be conducted for any future design or construction efforts.

**SELDOVIA STORMWATER MANAGEMENT PLAN:
DRAINAGE IMPROVEMENT PROJECTS (DIPS)**

MAIN ST (MNS)

Figure 2
2/20/2025

Note: Existing system to remain in place.



LEGEND

Drainage Basin	Existing Stormwater System	Proposed Outlet
Seldovia City Limits	Outlet	Proposed Catch Basin
Parcels	Catch Basin	Proposed System Pipe
Roads	System Pipe	Potential Sediment Basin
Contours (5ft)	Proposed DIP	
	Proposed Surface Flow Direction	

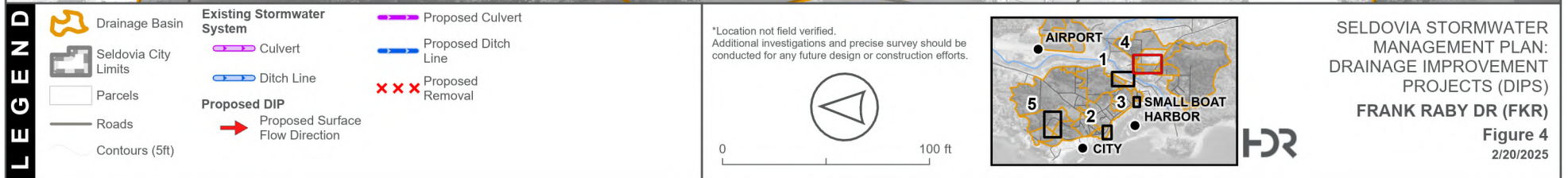
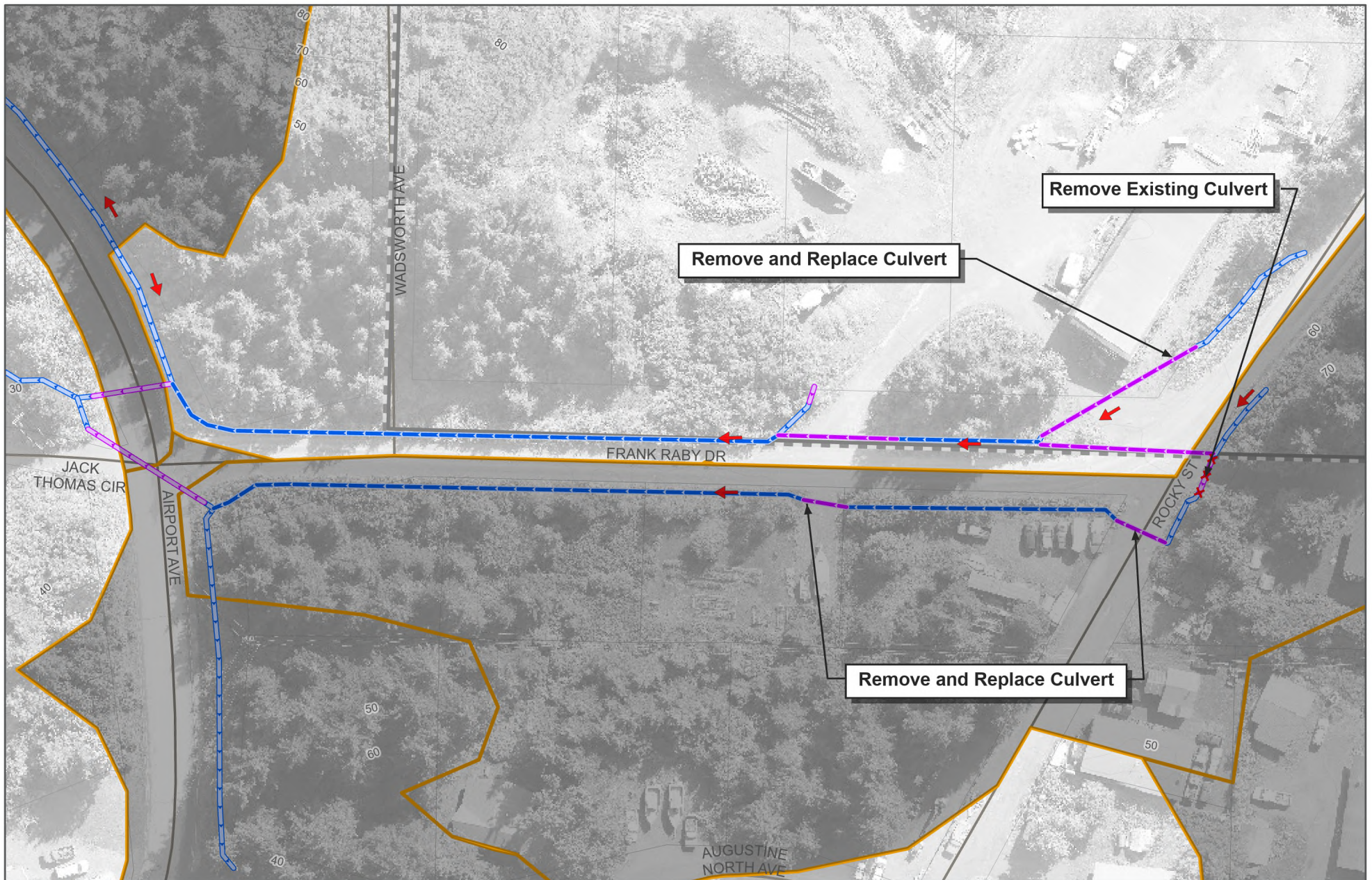
*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.

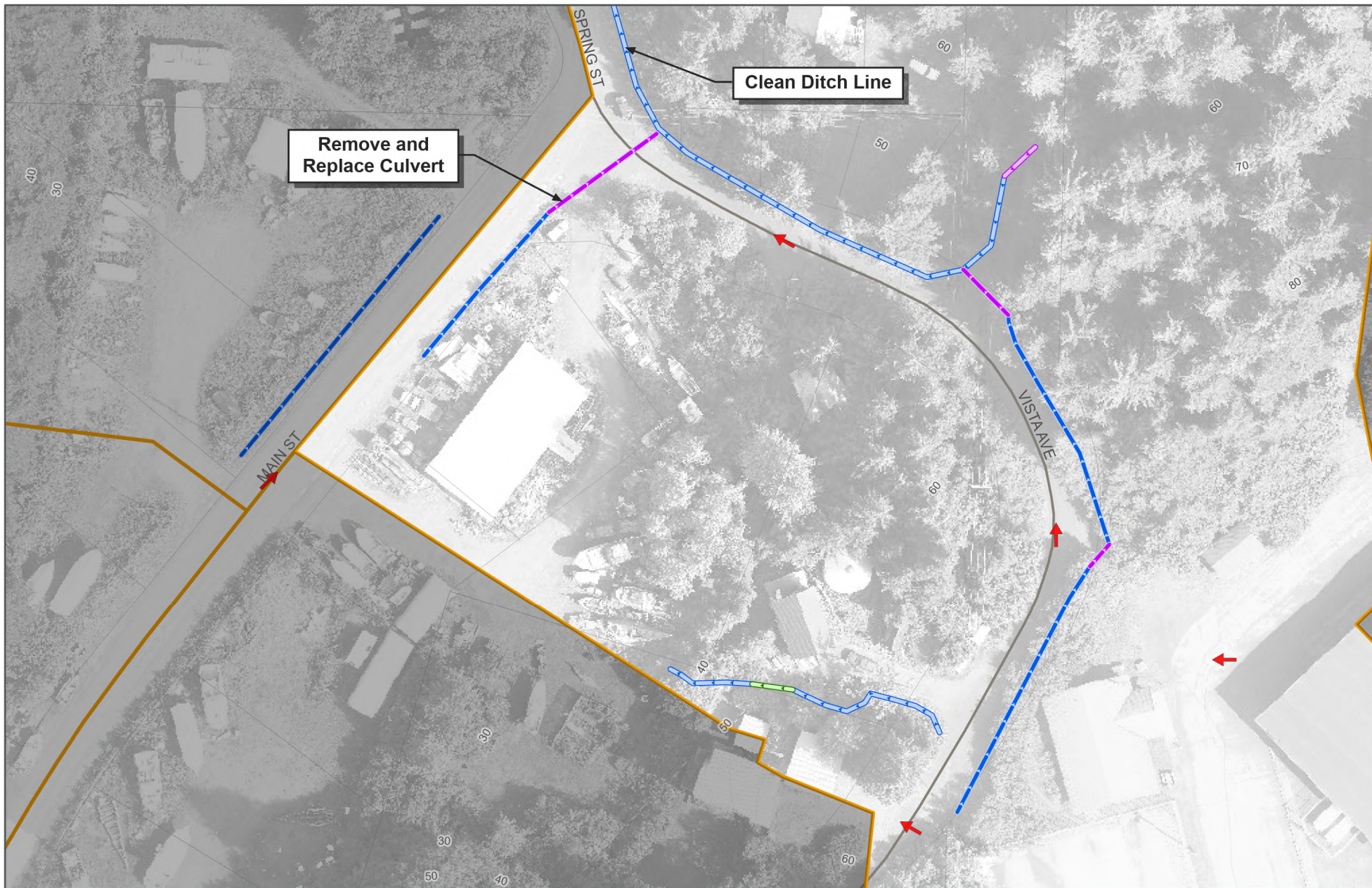


SELDOVIA STORMWATER
MANAGEMENT PLAN:
DRAINAGE IMPROVEMENT
PROJECTS (DIPS)
PENINSULA ST (PEN)

Figure 3
2/20/2025







LEGEND

- Drainage Basin
- Seldovia City Limits
- Parcels
- Roads
- Contours (5ft)

Existing Stormwater System

- System Pipe
- Culvert
- Ditch Line

Proposed DIP

- Proposed Surface Flow Direction
- Proposed Culvert
- Proposed Ditch Line

*Location not field verified.
Additional investigations and precise survey should be conducted for any future design or construction efforts.

**SELDOVIA STORMWATER
MANAGEMENT PLAN:
DRAINAGE IMPROVEMENT
PROJECTS (DIPS)
VISTA AVE (VIS)**

Figure 5
2/20/2025



Appendix G – Comments and Responses on Draft Stormwater Masterplan

Item No.	Page No.	Section	Reviewer	Comment Date	Comment	Response Date	Response
1	1 of 156	Cover	ADEC, L. Eldred	12/24/2024	Add the funding acknowledgment statement to beginning of report somewhere.	2/20/2025	Added funding statement after cover page using ADEC's provided language.
2	1 of 156	Cover	ADEC, L. Eldred	12/24/2024	I think this is a fantastic study and report. Seems like it's already been helpful for the City! So glad we've been able to work with the City on this project.	2/20/2025	Thank you for the feedback. We've also enjoyed working with all the collaborators on this project. And, thank you!
3	4 of 156	Acronyms and Abbreviations	ADEC, L. Eldred	12/24/2024	Be sure to spell these out the first time used in the text. I noticed a few instances where just the abbreviation was used.	2/20/2025	Reviewed and revised as needed.
4	4 of 156	Acronyms and Abbreviations	ADEC, A. Oleksiak	12/20/2024	Alaska Clean Water Actions (plural)	2/20/2025	Updated.
5	6 of 156	1, para. 1	ADEC, A. Oleksiak	12/20/2024	Actions	2/20/2025	Updated.
6	6 of 156	bullet 5	ADEC, A. Oleksiak	12/20/2024	based on evaluation criteria or based on a single evaluation criterion?	2/20/2025	Plural; updated.
7	6 of 156	bullet 6	ADEC, L. Eldred	12/24/2024	[inserted] :	2/20/2025	Added to the text.
8	6 of 156	1, para. 2	ADEC, A. Oleksiak	12/20/2024	Please include that this is known as nonpoint source pollution.	2/20/2025	Added to the text.
9	8 of 156	2, para. 1	ADEC, L. Eldred	12/24/2024	through an MS4 permit (The CGP still applies in small communities)	2/20/2025	Rewritten to include the Construction General Permit.
10	8 of 156	2, para. 2	ADEC, A. Oleksiak	12/20/2024	Not really accurate wording here. DEC identifies waters that are impaired through data collection (ACWA does fund water quality monitoring projects) and analysis as part of the Integrated Report. (you don't need to include that here though). You can copy some of the language from our ACWA webpage :) https://dec.alaska.gov/water/water-quality/nonpoint-source-control/alaska-clean-water-actions/	2/20/2025	Moved ACWA and Alaska Nonpoint Source Water Pollution Prevention and Restoration Strategy text to Section 1 Background. Discussed revision with ADEC.

Item No.	Page No.	Section	Reviewer	Comment Date	Comment	Response Date	Response
11	8 of 156	2, para. 2	City, H. Geagel	12/9/2024	I can look into it more myself later it needed; I am curious why Seldovia Bay is listed as an at-risk waterbody in ADEC's Alaska Nonpoint Source Water Pollution Prevention and Restoration Strategy report dated May 2020.	2/20/2025	Moved to Section 1 Background and added additional information to indicate ranking allows for ADEC funds to be used for projects that support water quality within the watershed. ADEC will discuss further with the City.
12	8 of 156	2, para. 5	ADEC, A. Oleksiak	12/20/2024	DEC's Water Quality Program also encourages managing stormwater by installing green stormwater infrastructure- techniques that use plants, soil, and other elements to capture, infiltrate, and treat runoff before it reaches surface waters.	2/20/2025	Incorporated.
13	9 of 156	3.2	ADEC, L. Eldred	12/24/2024	Interesting that the models are predicting decreased precipitation. I agree it's better to not use that data for future flood flow calculations.	2/20/2025	Agreed.
14	9 of 156	3.3, para. 1	ADEC, L. Eldred	12/24/2024	[replace] and	2/20/2025	Updated.
15	11 of 156	3.5	ADEC, L. Eldred	12/24/2024	What is "time of concentrations"? Is this the amount of precip it takes to have runoff according to slope?	2/20/2025	Added a definition to the text.
16	13 of 156	3.6, para. 1	ADEC, A. Oleksiak	12/20/2024	I'm not seeing any recent water quality monitoring work by DEC in the Seldovia area, but did you check to see if anyone else has collected water quality data through sampling or monitoring? Perhaps state whether or not water quality data were available? If not, that could be identified as a data gap and added in as a recommendation for future work :)	2/20/2025	Added SVT older (2013 and prior) water quality data. Added in Section 7 as a recommendation to review water quality knowledge gaps and reduce knowledge gaps as necessary.
17	13 of 156	3.6, para. 1	ADEC, A. Oleksiak	12/20/2024	No vehicles? Construction?	2/20/2025	Added Construction and Vehicle use water quality subsections.
18	13 of 156	3.6, para. 1	ADEC, L. Eldred	12/24/2024	Exposed sediment? Imperviousness?	2/20/2025	Added Land cover and impervious area water quality subsections.

Item No.	Page No.	Section	Reviewer	Comment Date	Comment	Response Date	Response
19	13 of 156	3.6, para. 2	ADEC, A. Oleksiak	12/20/2024	Could elaborate here on how many pollutants can bind to sediments and how presence of sediment can indicate potential presence of other water quality impacts? (turbidity, temperature, metals, etc...?)	2/20/2025	Added additional information under Sediment water quality subsection.
20	13 of 156	3.6 Road maintenance	ADEC, L. Eldred	12/24/2024	culvert? stormdrain?	2/20/2025	Stormwater inlet.
21	13 of 156	3.6 Road maintenance	ADEC, L. Eldred	12/24/2024	clean? [snow]	2/20/2025	Yes. Reorganized and added to this section to clarify that.
22	13 of 156	3.6 Road maintenance	ADEC, L. Eldred	12/24/2024	Is there ever accumulated trash left behind? If so, does the City or anyone sponsor spring trash cleanups before it blows away or washes into the waterways? If not, might be a good action to consider.	2/20/2025	Yes, the City hosts an annual spring clean up event. Added under 3.6 Water Quality.
23	13 of 156	3.6 Boating	City, H. Geagel	12/9/2024	Community input noted seeing sheens in the harbor that were thought to be due to stormwater pollution, leaking fuel tanks, or draining of bilge discharge (the water that collects in the lowest part of a vessel and is commonly susceptible to contaminants). How many sources? How long ago? This is the first time I am really comprehending this and I am wondering if this is a limited bias or an overall concern.	2/20/2025	We received 1 comment during the 2023 drainage survey stating, "There have been sheens in the harbor because of oil in the storm drains or fuel tanks leaking in the slough. Some boats still pump their bilges in the harbor and create a sheen." HDR did not see sheens in the harbor or storm system during visual inspections. The harbormaster noted an oil spill several years back that flowed into the stormwater system but otherwise a generally "clean" harbor. Rewritten to clarify the scale of this comment and added information about spill prevention and clean up materials Harbor has.
24	13 of 156	3.6 Boating	ADEC, L. Eldred	12/24/2024	possible future action is to become a certified Alaska Clean Harbor www.alaskacleanharbors.org	2/20/2025	Included in Sections 7.4 and 8.

Item No.	Page No.	Section	Reviewer	Comment Date	Comment	Response Date	Response
25	17 of 156	4.3, para. 2	ADEC, L. Eldred	12/24/2024	what are people concerned about with the lake? Is it naturally filling in?	2/20/2025	Removed Lake Susan reference in main report body as it is not directly stormwater and water quality but instead policy focused on how the community wishes to use and manage the lake long term.
26	17 of 156	5	City, H. Geagel	12/9/2024	Section 5 calls out potential projects and community input but does not mention staff and City priority projects.	2/20/2025	Added 5.1 Prioritized Drainage Projects and adjusted text to describe difference between Prioritized and Potential Drainage Projects.
27	23 of 156	6.2, para. 5	ADEC, A. Oleksiak	12/20/2024	perhaps specify "using green infrastructure techniques"	2/20/2025	Added to the text.
28	31 of 156	7.1, bullet 3	ADEC, A. Oleksiak	12/20/2024	Other resources: https://www.fairbankssoilwater.org/user-files/pdfs/GI_Manual_January2015.pdf https://www.epa.gov/green-infrastructure/epa-green-infrastructure-resources	2/20/2025	Added to the text.
29	31 of 156	7.1, bullet 7	ADEC, A. Oleksiak	12/20/2024	This could be its own bullet and fleshed out with other outreach and education efforts	2/20/2025	Added additional information for public education and outreach under Section 7.5 Community Involvement. Discussed potential funding options with ADEC.
30	31 of 156	7.2	ADEC, A. Oleksiak	12/20/2024	perhaps briefly describe process required by Seldovia to establish any regulations as ordinance (or other type of policy)?	2/20/2025	Added reference to City Code Title 2 and Title 13 to cover current stormwater related codes and how codes can be introduced.
31	32 of 156	7.3.1	ADEC, A. Oleksiak	12/20/2024	encourage good vehicle maintenance procedures to prevent leaks and spills. report spills to proper authority/ies https://dec.alaska.gov/spar/ppr/spill-information/reporting	2/20/2025	Added to the text.

Item No.	Page No.	Section	Reviewer	Comment Date	Comment	Response Date	Response
32	33 of 156	7.4	ADEC, A. Oleksiak	12/20/2024	Maybe not necessarily stormwater -related, but outreach on good fueling practices, Marine Sanitation Devices, and use of harbor pumpout station (does Seldovia have?)	2/20/2025	Per conversation with Harbormaster, Seldovia does not have fuel or pumpout facilities. Spill response is expanded in the text.
33	33 of 156	7.4	ADEC, A. Oleksiak	12/20/2024	Since we're here, maybe add "report spills to <proper authority/ies> "https://dec.alaska.gov/spar/ppr/spill-information/reporting	2/20/2025	Harbor has signage on spill reporting.
34	33 of 156	7.4	City, J. Yaeger	12/10/2024	The recommendation for a Stormwater Pollution Prevention Plan for the boatyard: while this seems like a good idea given the high potential for leaks of fuel, hydraulic fluid, etc. and the generally disturbed nature of the ground at the boatyards, I'm wondering if this should be for the boatyard or if it's meant for the harbor, especially given that Alaska Clean Harbors is listed as a resource?	2/20/2025	Suggest that the Storm Water Pollution Prevention Plan includes both the harbor and boat yard.
35	33 of 156	7.5, bullet 4	ADEC, A. Oleksiak	12/20/2024	stormwater and nonpoint source pollution :)	2/20/2025	Added to the text.
36	33 of 156	8	City, H. Geagel	12/9/2024	Partnership Programs- should we call out that Seldovia is included in the KPB SS4A planning grant that is currently ongoing?	2/20/2025	Yes, added a section for KPB.
37	33 of 156	8, para. 1	ADEC, A. Oleksiak	12/20/2024	What about partnerships with Seldovia Village Tribe? FEMA funding for flooding, NOAA Coastal resilience funds?. Any nonprofits that seem like logical partners?	2/20/2025	Partnership programs are listed by grant agency and SVT is included under FHWA. Added Homer Soil and Water Conservation District, KPB SS4A, and several NOAA opportunities (KBNERR, Coastal Resilience Fund, NCCOS).
38	33 of 156	8, para. 1	ADEC, A. Oleksiak	12/20/2024	We're currently working on our 2026-2030 strategy. I don't think you need to include that here, as the appendices typically remain the same, but we're pretty excited :)	2/20/2025	Noted.

Item No.	Page No.	Section	Reviewer	Comment Date	Comment	Response Date	Response
39	34 of 156	8, Alaska Clean Harbors	ADEC, A. Oleksiak	12/20/2024	Yes!! If the City is interested in the Clean Harbors program, please reach out to Mary.Inovejas@alaska.gov	2/20/2025	ADEC contact information sent to Harbormaster.
40	34 of 156	8, ADEC, para. 1	ADEC, A. Oleksiak	12/20/2024	grant funding and low-interest loans	2/20/2025	Added to the text.
41	34 of 156	8, ADEC, bullet 1	ADEC, A. Oleksiak	12/20/2024	Alaska Clean Water Actions	2/20/2025	Updated.
42	34 of 156	8, ADEC, bullet 1	ADEC, A. Oleksiak	12/20/2024	Since this was written, DEC has decided to award ACWA funding to two of the three projects for which Seldovia submitted proposals! :) Frank Raby/Vista Drive/Pickup Broom and the Main Street projects	2/20/2025	Excited to hear this.
43	34 of 156	8, ADEC, para. 2	ADEC, A. Oleksiak	12/20/2024	Clean Water SRF Projects (design and/or implementation) that address nonpoint source pollution are eligible for 100% principal forgiveness -(and don't include this in writing, but they typically have way more funding than our 319 nonpoint source funds!). Our nonpoint source section is working to learn more about the specifics (and how to sell those types of projects to eligible community partners) but if you are interested in more information: https://dec.alaska.gov/water/technical-assistance/state-revolving-fund/ . Since this was written, DEC has decided to award ACWA funding to two of the three projects for which Seldovia submitted proposals! :) Frank Raby/Vista Drive/Pickup Broom and the Main Street projects	2/20/2025	Thank you for the additional information. Excited to hear this.
44	34 of 156	8, ADEC, para. 2	ADEC, A. Oleksiak	12/20/2024	The Citywide Infiltration Basin study would be an excellent project to propose for SRF funding! Be sure to emphasize how it addresses nonpoint source pollution.	2/20/2025	Will consider.
45	103 of 156	Appendix C of Appendix C	ADEC, A. Oleksiak	12/20/2024	Thank you for including this! Incredibly helpful and important!	2/20/2025	Thank you for your review.