Design Study Memorandum

Tasha Drive Reconstruction

MOA PM&E Project #20-15
December 2022

Prepared for:

Municipality of Anchorage
Project Management & Engineering Department
4700 Elmore Road
Anchorage, AK 99519

Prepared by:

CRW Engineering Group, LLC
3940 Arctic Blvd, Suite 300
Anchorage, AK 99503

Executive Summary

The Municipality of Anchorage (MOA) Project Management and Engineering (PM&E) Department has contracted with CRW Engineering Group, LLC (CRW) to provide professional services to develop and evaluate alternatives to improve Tasha Drive from Flamingo Drive to Northwood Street. The purpose of the Design Study Memorandum (DSM) is to summarize existing conditions, present relevant design criteria, evaluate conceptual design alternatives, and provide estimated project costs.

The purpose of the project is to improve the roadway to meet current Municipality of Anchorage (MOA) standards for a local roadway. Improvements include adjusting the horizontal and vertical alignment, new surfacing, new roadway structural section, signage, storm drainage, landscaping, and lighting.

Tasha Drive was constructed in 1970's and is located in south Anchorage east of Flamingo Drive and west of Northwood Street.

Public Involvement efforts to date include:

- Sand Lake Community Council meeting May 2021
- Creation of project website (www.tashadrivereconstruction.com)
- Project kick-off mailers and questionnaires to residents in the project area

Existing Conditions and Recommended Improvements

Roadways

Tasha Drive is a local roadway with rolled curb and gutter and is approximately 33 feet wide measured to the back of curb within a 50-foot-wide right-of-way (ROW). The pavement and curb are heaving and breaking and have settled in many locations. There are no pedestrian facilities along the project corridor, however 88th Avenue and Northwood Street both have sidewalks (north and west side) and pathways (south and east side) that essentially link both ends of Tasha Drive.

The proposed roadway will remain classified as a local roadway. The roadway alignments will be centered on the ROW and match existing cross section with two 11-foot lanes, two 3.5-foot shoulders, and rolled (Type 2) curb and gutter. The recommended road structural section was developed based on a Berg one-dimensional thermal analysis to determine a design that limits the depth of frost based on the Limited Subgrade Method as specified by the MOA Design Criteria Manual (DCM). The proposed structural section includes 2-inches of AC Pavement, 2-inches of leveling course, 16-inches of Type II-A classified fill, 2-inches insulation board, 24-inches of Type II classified fill, and geotextile fabric. Based on our groundwater measurements, the project has shallow groundwater that varies with environmental variations, seasonal conditions, and man-made influences. Dewatering during excavation and construction will be required with additional considerations for excavation stability depending on groundwater conditions at the time of construction.

Drainage

The drainage analysis for this DSM focuses on the design standards and requirements identified in the Anchorage Stormwater Manual (ASM) regarding drainage design and analysis, as well as addressing the components typically provided in a standalone Stormwater Management Report. Tasha Drive has a high point between Flamingo Drive and Kathleen Drive. Drainage generally drains overland to the east of this high point towards Northwood Street and west of the high point towards Flamingo Drive. A short segment of Kathleen Drive drains south towards Tasha Drive, otherwise no additional stormwater runoff is contributed to the project corridor. Tasha Drive experiences ponding in low lying areas that don't effectively drain due to irregular curb and gutter, roadway degradation, and an undulating roadway with several low spots.

There is no piped storm drain systems along Tasha Drive with the exception of a catch basin and catch basin manhole located at the eastern limits of the project near Northwood Street. However, there are two MOA maintained piped storm drain systems that collect stormwater runoff from the project area. One is located along Northwood Street and the other extends along W. 88th Avenue. Refer to APPENDIX K for the MOA Storm Drain and Drainage Atlas (SW2327) for the project area showing these two storm drain systems. The drainage basins that contribute runoff to the project area were delineated using topographical mapping, aerial photography, land cover, and MOA Watershed Management's hydrography geodatabase (HGDB). The contributing drainage area is characterized by a fully developed residential neighborhood with single family homes (zoned R-1), municipal roadways constructed with Type 2 (rolled) curb and gutter, and asphalt surfacing. Land cover generally consists of pervious areas, such as lawns and tree canopy, and impervious surfaces like roadways and roof.

A hydrologic and hydraulic (drainage) model was developed to analyze the existing and proposed conditions for the project area. The proposed drainage system consists of extending a continuous gravity, piped subdrain system along Tasha Drive from Flamingo Street to the east and connect to the existing system on Northwood Street. The system will be constructed with corrosion resistant corrugated polyethylene pipe (CPEP) ranging in size from 12-inches (catch basin leads) to 18-inches (main line pipe). All pipes will be perforated to allow groundwater into the system, effectively decreasing the amount of water within the roadway structural section. The main line pipe is routed near the centerline of the roadway and maintains the required separation distance from the water and sewer mains. The proposed subdrain along Tasha Drive is adequately sized to convey both the 10- and 100-year storm events without surcharging. Comprehensive drainage model results, input parameters, and other related data can be referenced in APPENDIX K.

Other Considerations

Private improvements including fences, retaining walls, mailboxes, sprinkler systems, and mature trees are located within the ROW behind the existing curb. There are several driveways that have steep existing grades above the roadway and a handful of driveways sloping away from the road towards the homes. Many driveways are experiencing deterioration similar to the roadway.

Chugach Electric Association (CEA) owns two light poles along Tasha Drive and MOA owns two light poles at the intersection of Northwood Street. Underground electric, telephone, cable, water, sewer, and gas lines serve the residents along Tasha Drive. All luminaire poles and light fixtures within the project area will be removed with the exception of the CEA light on the wood pole at the intersection of Northwood Street and Tasha Drive. A new continuous lighting system with LED luminaires will be installed to meet minimum illumination requirements.

Total Project Costs

Estimated total project costs for the recommended alternative are shown below.

Category	Alternative 1 (Recommended)
Design & Management Total (estimated)	$942,860
ROW Acquisition Total	$20,000
Utility Relocation (15% Contingency) Total	$292,000
A. Design, ROW Acquisition, Utility Relocation	**$1,254,860**
Construction	
Drainage & Roadway Improvements	$1,857,338
Construction Contingency (15%)	$279,000
Construction Management / Inspection / Testing	$208,022
B. Total Estimated Construction Cost (rounded)	**$2,344,360**
C. Overhead / Grant Accounting	**$635,156**
Total Estimated Project Cost (A + B + C)	**$4,234,376**

Table of Contents

List of Figures

List of Tables

Appendices

1.0 Introduction and Background

MOA Project Management & Engineering (PM&E) has contracted with CRW Engineering Group, LLC (CRW) to provide professional services to develop and evaluate alternatives to improve Tasha Drive from Flamingo Drive to Northwood Street (see FIGURE 1 for project location and vicinity map). The scope of this Design Study Memorandum (DSM) is to review the existing conditions along the project roadway, evaluate improvement alternatives and recommend a preferred alternative for design and construction.

Figure 1 - Project Location and Vicinity Map

1.1 Purpose and Need

The existing roadway is in poor condition with cracked pavement and heaved, irregular curbs. These conditions lead to potholes, puddles, an uneven traveling surface, and increased maintenance costs. The purpose of this project is to reconstruct the roadway, improve drainage, alleviate maintenance issues, upgrade the roadway lighting, and provide a stable base to extend the life of the roadway.

Existing Ponding and Heaved, Irregular Curbs

2.0 Existing Conditions

2.1 Area Context and Zoning

Tasha Drive is part of Cambrian Park Subdivision and is situated west of Northwood Street and east of Flamingo Drive in south Anchorage. The neighborhood is zoned R-1, Single-Family Residential. The parcels directly adjacent to the project roadway consist of 29 single family homes. The majority of the homes were built in the 1970's prior to the establishment of many MOA driveway codes.

2.2 Roadway Characteristics and Conditions

Tasha Drive is classified as a Secondary (local) Street. The existing roadway grades in the project area are generally flat east of Kathleen Drive. In this area, drainage generally drains overland towards the east into an existing system at Northwood Street. Two curb inlet catch basins are located on Tasha Drive, just west of Northwood Street. These catch basins are intended to collect the entirety of Tasha Drive from approximately 100 feet east of Flamingo Drive to Northwood Street. However, there are low spots along the roadway where drainage can't effectively drain to a catch basin; during spring break up or large rain events, these areas experience ponding in the roadway. Drainage that does manage to enter the MOA system at Northwood Street eventually discharges to Campbell Creek, approximately 700 feet south of the project area.

West of Kathleen Drive, the roadway grade is moderate, at approximately 3%. The western 100 feet of Tasha Drive drains west to Flamingo Drive. Two curb inlet catch basins are located on Flamingo Drive just north of 88th Avenue. These catch basins collect drainage from Flamingo Drive and the western portion of Tasha Drive. Drainage entering the MOA system at 88th Avenue connects to the Northwood Street System, discharging at the same location to Campbell Creek.

The existing roadway pavement conditions are very poor with cracking, settling, and heaving especially east of Kathleen Drive. Rolled curb and gutter is present along the entire project corridor, however, some sections of curb are broken and undulating.

Existing Roadway Pavement Conditions

2.3 Right-of-Way and Easements

Tasha Drive has an existing ROW width of 50 feet and the existing roadway is approximately centered in the ROW. There are four 10-foot utility easements between Parcels 1 & 2, 27 & 26, 22 & 23, and 9 & 10. A 20-foot sanitary sewer easement is located between parcels 21 & 22. A 15-foot utility easement parallels the east side of Parcels 14 & 15 at the Northwood Street and Tasha Drive intersection.

2.4 Environmental

There are no wetlands, creeks, or flood plains within the project limits. According to the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Program Database, there are no active sites in or within 1,000 feet of the project area.

2.5 Drainage & Soils

Existing drainage conditions are discussed in Section 4.0 below, and the existing soil conditions, including the geotechnical investigation, are discussed in Section 5.0 below. A full geotechnical report with recommendations is made part of this report as APPENDIX E.

2.6 Lighting

The lighting on Tasha Drive is non-continuous. There are CEA owned and operated, direct imbedded lights at the Flamingo Drive and Tasha Drive intersection and the Kathleen Drive and Tasha Drive intersection and one light pole on Tasha Drive between Kathleen Drive and Northwood Street. There is also one CEA owned light on a power pole on the northeast corner of the Northwood Street and Tasha Drive intersection. MOA owns one light pole with pile foundation at the intersection of Northwood Street and Tasha Drive. All of the existing light fixtures are Light-Emitting Diode (LED).

2.7 Landscaping

Private improvements including fences, retaining walls, mailboxes, planter boxes, small shrubs and mature trees are located in the ROW behind the curb. These private improvements within the ROW

hinder available snow storage areas. During the project site walk on October 21, 2022, the following items were noted to appear to be in the ROW:

- 8 Fences
- 7 Mature Trees
- 12 Hedges and Small Shrubs
- 2 Retaining Walls

During the design phase, the impact to these improvements within the ROW will be analyzed in further detail. Where feasible, existing improvements will be protected with measures such as root pruning or tree protection zones.

2.8 Utilities

Existing utilities within the project area include telephone, cable television, electric, fiber optic, storm drain, natural gas, water, and sanitary sewer (See APPENDIX A for the layout, size, and type of existing utility). The location of utilities in the project planning documents and drawings are based on land surveying, utility company facility maps, and utility company locates.

2.8.1 Water

Anchorage Water and Wastewater Utility (AWWU) owns and operates an 8-inch ductile iron pipe located approximately 10-feet east of the Flamingo Drive; this waterline tees at the Tasha Drive intersection and a 6-inch ductile iron pipe runs underneath the north side of Tasha Drive, approximately 10-feet offset from the center of ROW. The 6-inch water line connects to an 8-inch water line located on the east side of Northwood Street. AWWU also operates a 6-inch ductile iron waterline on Kathleen Drive located on the east side of the roadway, approximately 10-feet offset from centerline.

2.8.2 Sanitary Sewer

AWWU owns and operates asbestos concrete pipe sewer mains within the project corridor that serve the adjacent properties. The sewer main drains both east and west along Tasha Drive, toward the middle of the project corridor, where it then travels south to 88th Avenue through a utility easement located between homes. The sewer main just west of Northwood Drive was potholed in the fall of 2022 to confirm its depth and location. An attempt to locate existing sewer services was also made at that time. However, the high ground water and sloughing soils made it infeasible to locate the sewer services or main at that time.

2.8.3 Electric

CEA owns and operates light poles and underground electric facilities along Tasha Drive and Flamingo Drive. CEA has a streetlight at the intersection of Flamingo Drive and Tasha Drive, a streetlight at the intersection of Tasha Drive and Kathleen Drive, and a street light along the northside of Tasha Drive between Kathleen Drive and Northwood Street.

2.8.4 Telephone

Alaska Communications (ACS) owns and operates underground copper cables that serve residents of Tasha Drive and Flamingo Drive from the backside of the parcels.

2.8.5 Cable & Fiber Optic

General Communications (GCI) owns and operates underground .500 coaxial cables that serve individual residents through the backside of the parcels.

2.8.6 Natural Gas

ENSTAR Natural Gas Company (ENSTAR) owns and operates underground 2-inch steel natural gas pipeline within the project corridor. The 2-inch steel line parallels the west side of Flamingo Drive and the south side of Tasha Drive through the project limits.

2.9 Private Improvements and Nonconformities

Each property has a single mailbox in the ROW behind the curb and a driveway that extends to the curb. Other private improvements within the ROW include fences, retaining walls, shrubs, boulders, sprinkler systems, and mature trees. These items are not allowed to be located within the ROW and hinder MOA Street Maintenance Department activities, especially snow removal and storage.

Existing Mailboxes and Landscaping

3.0 Traffic and Safety Analysis

3.1 Traffic Volumes and Operations

Volume and speed data was collected on Tasha Drive approximately 150 feet west of the Northwood Street intersection over a four day period in late May 2021. The collected data was adjusted for day and month, based on the nearest permanent traffic recorder. Additionally, traffic volumes were generated from the Institute of Transportation Engineers (ITE) Trip Generation Manual (11th Edition) to supplement the traffic data collected on-site. Data generated from Trip Generation Manual combined with traffic volume data collected on-site were used to determine the annual average daily traffic (AADT) for Tasha Drive (see Appendix F for trip generation calculations.) Existing AADT volumes and 85th percentile speeds are shown in Table 1.

Table 1 – Existing AADT Traffic Data

Location	AADT	85th Percentile speed (mph)
Tasha Drive – Kathleen to Northwood	90	19
*Tasha Drive- Flamingo to Kathleen	292	--

**Data from ITE Trip Generation, 11th ed.*

A parking study was conducted to document the current use of on-street parking for consideration in the design of the proposed improvements. The parking study was based on observations from four separate site visits. Site visits were organized to include one weekday afternoon/evening and one weekend afternoon/evening and took place on Wednesday, May 19, 2021 and Saturday, May 15, 2021. Parking demand is summarized below in Table 2 (see Appendix F for more information)

Table 2 – On-street Parking Demand

Segment	Maximum on-street parking demand observed (vehicle count)
Flamingo to Kathleen	1
Kathleen to Northwood	3

3.2 Crash Data

MOA crash data from 2016-2021 was reviewed for the entire project corridor. No crashes were reported in the project corridor during this time.

3.3 Speeds

The posted speed along the entire project corridor is 25 miles per hour (mph). The 85th percentile speed represents the speed at which 85% of the vehicles are traveling at; on-site data collection noted the 85th percentile speed along Tasha Drive is 19 mph. Additionally, residents along Tasha Drive did not note speeding as an issue.

3.4 Intersections/Access Control

Within the project limits, Tasha Drive intersects with Flamingo Drive, Kathleen Drive, and Northwood Street. The intersection with Flamingo Drive is a three-way, stop controlled intersection with Tasha Drive being the stopped approach. The Kathleen Drive intersection is a three-way, stop controlled intersection with Kathleen Drive being the stop controlled approach. The intersection with Northwood Street is a four-way, stop controlled intersection with the east and west approaches of Tasha Drive being the stopped approach. Twenty-five residential driveways connect directly to Tasha Drive in the project area.

3.5 Other traffic studies

The Municipality of Anchorage 2022-2023 Safe Walking Routes to School Manual notes that Tasha Drive is within the walking boundary for Chinook Elementary School. The manual shows that while children along Tasha Drive can walk to school, Tasha Drive is not classified as a primary walking route for the school. Instead, children are expected to utilize the existing sidewalks on West 88th Avenue.

4.0 Drainage Analysis

This section of the DSM focuses on the design standards and requirements identified in the Anchorage Stormwater Manual (ASM) regarding drainage design and analysis, as well as addressing the components typically provided in a standalone Stormwater Management Report.

Ponding and Heaving Curb & Gutter

This project falls under the *Medium Project* category based on the definition provided in Section 3.3.1.3 of the ASM:

- Project will disturb 10,000 or more square feet of land.
- The fraction of impervious, lawn, or other landscaping, and naturally vegetated landcover types present at pre-development of the project will not change by more than 5% as a result of the proposed improvements.

This report will summarize the drainage conditions within the project area for the pre- and post-development conditions and evaluate design alternatives to improve overall drainage in the project area. Refer to SECTION 9.0 for the post-development conditions.

4.1 Existing Conditions

The condition of the existing pavement and curb and gutter is very poor with cracking, settling, and heaving along Tasha Drive. High groundwater and poor soils were identified during the geotechnical investigation. These conditions have resulted in the roadway degradation issues noted above. Additionally, Tasha Drive experiences ponding in low lying areas that don't effectively drain, further exacerbating the issue. These conditions are worsening over time, causing increased maintenance costs for MOA. The poor road conditions have grown to be an issue and burden for residents on Tasha Drive, as was noted during the public involvement (PI) outreach efforts (see APPENDIX I for a PI summary).

Tasha Drive has a high point between Flamingo Drive and Kathleen Drive. Drainage generally drains overland to the east of this high point towards Northwood Street and west of the high point towards Flamingo Drive. A short segment of Kathleen Drive drains south towards Tasha Drive, otherwise no additional stormwater runoff is contributed to the project corridor.

4.1.1 Conveyance Systems

There are no piped storm drain systems along Tasha Drive with the exception of a catch basin and catch basin manhole located at the eastern limits of the project near Northwood Street. However, there are two MOA maintained piped storm drain systems that collect stormwater runoff from the project area. One is located along Northwood Street and the other extends along W. 88th

Avenue. Refer to APPENDIX K for the MOA Storm Drain and Drainage Atlas (SW2327) for the project area showing these two storm drain systems.

The Northwood Street system extends from the Tasha Drive intersection to the south with manholes located in the center turn lane. This system extends beyond Northwood Street and discharges into an open channel prior to flowing into Campbell Creek. The main line pipe from Tasha Drive to the manhole south of Northwood Street is 18-inch corrugated polyethylene pipe (CPEP), Type SP. A separate 8-inch CPEP, Type SP, runs parallel to the main line pipe on the west side of Northwood Street and connects to the catch basins located on that side of the road. A catch basin and a catch basin manhole are located just west of the curb returns on Tasha Drive. These structures are intended to capture the majority of stormwater runoff from the project corridor. However, due to the undulating roadway with several low spots, much of the runoff is unable to effectively drain to these structures. These structures are connected via 10-inch CPEP leads and tie into the manhole located on Northwood Street.

The W. 88th Avenue system runs parallel with the roadway and drains west to east. The pipe segments south of Flamingo Drive consist of 24-inch perforated corrugated metal pipe (CMP) and perforated polyethylene pipe (CPEP, Type SP). Catch basins are located on the north side of the Flamingo Drive and W. 88th Avenue intersection that intercept runoff from Flamingo Drive. As noted above, a small segment of Tasha Drive drains toward Flamingo Drive, which enters this system.

The W. 88th Avenue system connects to the Northwood Street system at the most downstream manhole located just south of Northwood Street. The combined flow from both systems is routed through an oil and grit separator (OGS) structure via a 30-inch CMP.

4.1.2 Contributing Drainage Area

The drainage basins that contribute runoff to the project area were delineated using topographical mapping, aerial photography, land cover, and MOA Watershed Management's hydrography geodatabase (HGDB). Based on HGDB mapping, the project area and surrounding drainage basin is located within the MOA subbasin #864 in the Lower Campbell Creek watershed. Refer to FIGURE 1, APPENDIX K which shows the project location and watershed boundaries within Anchorage.

MOA subbasin #864 was further refined for this project to better reflect the drainage contributing directly to the project corridor and the storm drain systems described in SECTION 4.1.1 above. For this drainage analysis, three catchments were delineated for the existing condition. See FIGURE 3, APPENDIX K for a map showing the project catchment areas.

The contributing drainage area is characterized by a fully developed residential neighborhood with single family homes (zoned R-1), municipal roadways constructed with Type 2 (rolled) curb and gutter, and asphalt surfacing. Land cover generally consists of pervious areas such as lawns and tree canopy, and impervious surfaces like roadways and roofs.

4.1.3 Water Quality Treatment

Stormwater runoff from the W. 88th Avenue and Northwood Street systems is treated via the oil-grit separator (OGS) located south of Northwood Street and just upstream from the outfall. Additional treatment is provided naturally as stormwater flows through a 150-foot vegetated swale that extends from the pipe outfall to Campbell Creek. The vegetated swale allows sediment/particulates not captured by the OGS to settle out in the mature vegetation prior to the runoff entering the creek.

4.1.4 Storm Drain Condition Assessment

A storm drain condition assessment was performed by CRW in early October 2022. The purpose of the assessment was to evaluate the condition of the existing storm drain infrastructure located along Northwood Street and W. 88th Avenue discussed in SECTION 4.1.1 above. This project plans to extend a new storm/subdrain system along Tasha Drive and potentially connect to these existing systems. This assessment will be used during the design phase to determine if connecting to these systems is viable based on condition, age, size, and location. Refer to APPENDIX D for the complete assessment.

4.2 Hydrologic and Hydraulic Analysis

A hydrologic and hydraulic (drainage) model was developed to analyze the existing and proposed conditions for the project area. The methodology and key input parameters required to prepare this drainage analysis model are described below.

4.2.1 Design Storm Depth and Distribution

The design storm distribution used for this drainage analysis is based on the Anchorage and Eagle River 24-hour storm duration as provided in Appendix D of the ASM. The base design storm depth values noted below are from Table 4.2-1 of the ASM. Based on the project location, the base storm depths did not require an adjustment for orographic effects (proximity to mountainous areas). Refer to FIGURE 2, APPENDIX K for the Anchorage Orographic Map.

The 10-year, 24-hour design storm was used to evaluate if the existing pipes are adequate to convey peak flows. This storm event will also be used to size proposed piping. The 10-year design storm has a base depth of 2.28 inches (Table 4.2-1, ASM). The 100-year, 24-hour design was modeled to evaluate flood bypass conditions. The 100-year design storm has a base depth of 3.39 inches (Table 4.2-1, ASM).

4.2.2 Model Information

The Soil Conservation Service (SCS) TR-55 method was used for this drainage analysis. The drainage analysis was developed using 2019 Autodesk Storm and Sanitary Analysis (SSA) computer software. This software allows the user to analyze the stormwater runoff response from the project area and calculate data such as peak flow at design points, evaluate pipe sizing, and identify problems areas (e.g. flooding, surcharged pipes, etc.).

Precipitation losses were estimated using SCS Curve Numbers based on land cover type, slope, and the hydrologic soil group for the project area. Soil Type B was used for this drainage analysis effort based on the project location. Soil type was determined using the Web Soil Survey (WSS), an online tool operated by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Refer to APPENDIX K for the hydrologic soil group report from the WSS.

The time of concentration (Tc) was calculated for each contributing catchment using the SCS TR-55 method. Time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of a watershed to the design point or point of interest.

4.2.3 Model Results

The results from the drainage modeling effort show that the existing catch basin leads for the Northwood Street and W. 88th Avenue systems are adequately sized to accommodate both the 10- and 100-year storm events without surcharging.

Peak flows are shown below for runoff entering the Northwood Street and W. 88th Avenue for the 10-year and 100-year storm events.

Table 3 - Peak Flows (Existing Conditions)

Design Point (MOA GIS ID)	Peak Runoff 10-yr, 24-hr Event (cfs)	Peak Runoff 100-yr, 24-hr Event (cfs)
Northwood Street (32327-174)	1.04	2.72
W. 88th Avenue (32327-037)	0.75	1.92

Comprehensive drainage model results, input parameters, and other related data can be referenced in APPENDIX K. Note that the naming convention used for the storm drain structures and pipe in the existing drainage model and in the table above match the MOA HGDB mapping identification number.

5.0 Geotechnical Analysis

5.1 Existing Conditions

CRW conducted a geotechnical investigation for the Tasha Drive Reconstruction project, which consisted of reviewing existing historic borehole logs and completing a field investigation along the project alignment.

5.1.1 Historic Borehole Logs

CRW consulted the online MOA Soil Boring map to evaluate historic borings in the project area. Only one boring along Tasha Drive has been performed according to the MOA Boring map. The single test hole was completed by the MOA in 1981, along Tasha Drive. Soils encountered were visually classified and consisted generally of silty sand over the full depth of the borehole to 9 feet Below Ground Surface (BGS). Groundwater was encountered at 5 feet BGS. The historic borehole log is included in APPENDIX E.

5.1.2 CRW Field Investigation

CRW performed a geotechnical field investigation on June 2nd, 2021. The final report was published in October of 2022 and can be found in APPENDIX E. The investigation consisted of drilling and sampling 5 boreholes along Tasha Drive and installing 3 piezometers to monitor groundwater levels. All borings were advanced to a depth of 17 feet BGS.

Based on recovered samples, the existing pavement thickness ranged from 1.25 to 2.25 inches. Soil conditions consisted of 1.5 to 5 feet of granular fill underlain by fine-grained material. The granular soil was classified as poorly graded sand with silt and gravel, and frost susceptibility was estimated to range between F-1 and F-2 based on the MOA frost classification. The fine-grained material below the granular fill consisted of poorly graded sand, silty sand, silt with varying sand content, and clay. Moisture content ranged from 13 to 29 percent and fines contents ranged from 5 to 100 percent. Frost susceptibility was estimated to range between F-2 and F-4 based on the MOA frost classification.

The groundwater table was observed during drilling at depths ranging from 5 to 15 feet BGS. Multiple subsequent groundwater measurements were made at different times of year and varied from 0.2 to 13.3 feet BGS. Heavier amounts of rain occurred in late summer to early fall of 2022 resulting in a dramatic decrease in the depth to groundwater.

Photoionization detector (PID) readings were collected for each sample during the field investigation per the MOA Design Criteria Manual (DCM) to screen for potential contaminants. No readings collected at the time of the field investigation exceeded 4.5 ppm.

Detailed descriptions of subsurface conditions can be found on the borehole logs in APPENDIX E.

5.2 Analysis and Recommendations

The recommended road structural section was developed based on a Berg one-dimensional thermal analysis to determine a design that limits the depth of frost based on the Limited Subgrade Method as specified by the MOA DCM. The analysis uses the default historic Anchorage climate parameters with typical soil parameters for classified fill and in-situ soils. The recommended structural section is shown below and in APPENDIX E:

- 2 inches of asphalt concrete
- 2 inches of leveling course
- 16 inches of MOA Type II-A classified material
- 2 inches of rigid board insulation (R-4.5 per inch minimum)
- 24 inches of MOA Type II classified material
- Separation geotextile

Based on our groundwater measurements, the project has shallow groundwater that will vary with environmental variations, seasonal conditions, and man-made influences. Dewatering during excavation and construction will be required with additional considerations for excavation stability depending on groundwater conditions at the time of construction. A detailed discussion on dewatering recommendations, along with additional geotechnical recommendations regarding site preparation, excavations, frost depth, compaction, rigid insulation, geotextiles, subdrains, and reuse of material can be found in the final geotechnical report in APPENDIX E.

6.0 Design Criteria and Standards

Project design criteria are based on the roadway characteristics, functional classification, and road ownership. The Tasha Drive project roadway is classified as secondary (local) urban residential roadway that is owned and maintained by the MOA. The MOA PM&E DCM provides detailed design criteria for the development of roadway and infrastructure within the MOA.

6.1 Design Criteria

A summary of roadway design criteria pertinent to this project can be found in Table 4 below. This project will meet the standards for a secondary (local) street. However, the roadway cross section will match the existing roadways cross section of 33 feet from back to curb to back of curb with two 11-foot lanes, 3.5-foot shoulders, and rolled curb and gutter. The project investigated reducing the roadway width to 31 feet to comply with the DCM, however the location of existing sewer manhole and water valves would result in surface features within the proposed curbline for a 31-foot roadway width. Thus, it is proposed to retain the existing roadway width of 33 feet.

Table 4 - Design Criteria Summary

	Criteria	Design Standard Value	Reference
Traffic Data	Functional Classification	Secondary Street: Urban Residential	OSH&P
	AADT (Average)	90	2021 Traffic Study
	Design Vehicle	WB-50	DCM 6.4 B
	Design/Posted Speed	25 MPH	DCM Table 1-6
Horizontal Alignment	Horizontal Curve Radius, Minimum, No Super-elevation	150 ft	DCM Table 1-9
	Stopping Sight Distance, Min	155 ft	DCM Figure 1-20
	Clear Sight Triangle Length	280 ft	DCM Figure 1-19
Vertical Alignment	Vertical Grade, Maximum	6.0%	DCM 1.9.D.2.b
	Vertical Grade, Minimum	0.5% for street w/ curb and gutter	DCM 1.9.D.2.a
	Vertical Curve K-Value, Min, Crest	12	DCM Figure 1-16
	Vertical Curve K-Value, Min Sag	26	DCM Figure 1-17
Cross Section	Number of Moving Lanes	2	DCM Table 1-6
	Moving Lane Width	10 ft	DCM Table 1-6
	Shoulder Width (No Parking Lane)	3.5 ft	DCM Table 1-6
	Curb & Gutter	Type 2 (Rolled)	DCM Figure 1-13
	Side Slopes	2H:1V max	DCM 1.9.D.5
	Snow Storage Area	7 ft from back of curb	MOA Title 21.08.030.F.3
	Pedestrian Facilities	Not Required	DCM Table 1-6
		Install on both sides of street	MOA Title 21.07.060.E.2.b
Intersections & Driveways	Curb Return Radius at Residential Side Streets	20 ft	DCM Figure 1-22
	Curb Return Radius at Arterial or Collector Side Streets	30 ft	DCM Figure 1-22
	Max driveway grade: residential	± 10%	DCM Appendix 1D
	Landing grade/length: residential	± 2% for 12 ft	DCM Appendix 1D

6.2 Lighting

Lighting systems shall be designed to the DCM's Chapter 5 criteria and enhance traffic and pedestrian safety. A properly designed lighting system will:

- Provide the minimum maintained average luminance and illuminance levels specified for roadways, sidewalks, and intersections.
- Provide a uniformity of lighting that does not exceed the maximum ratios specified for roadways, sidewalks, stand-alone pathways, and intersections.
- Minimize construction and maintenance costs.
- Avoid adverse impacts to adjacent properties.
- Reveal hazards to pedestrians and vehicular traffic.

The MOA has retrofitted many existing luminaire poles with luminaires that use LEDs as the light source and new roadway projects with lighting improvements now incorporate LED lighting into the design. The new proposed LED lighting system for this project will be designed to provide the light levels specified in the DCM as summarized below:

6.2.1 Roadway (not including intersections):

For a local roadway with low pedestrian activity, the DCM recommends a minimum maintained average of 0.4 foot-candles with an average-to-minimum uniformity ratio no greater than 6:1 and a veiling luminance ratio no greater than 0.4.

6.2.2 Pedestrian Facilities:

It is anticipated that pedestrian activity along the project roadways will be in the low range per Chapter 5 of the DCM. If adjacent pedestrian facilities are present, the DCM requires a minimum maintained average of 0.4 foot-candles with an average-to-minimum uniformity ratio no greater than 4:1 for the low pedestrian volume criteria.

6.2.3 Intersections:

For the purpose of lighting intersections, the DCM uses the following roadway classifications based upon the AADT (note these do not apply to standard MOA DCM street classifications):

- Major: over 3,500 AADT
- Collector: 1,500 to 3,500 AADT
- Local: 100 to 1,500 AADT

Below, in TABLE 5, is a summary from the DCM of lighting for intersections. This table will be used to design lighting improvements at the project intersections. Intersection lighting classifications for the project intersections will be based upon the design year AADT as stated in SECTION 3.0 Traffic and Safety Analysis.

Table 5 - Illuminance for Intersections (MOA DCM Table 5-5)

Functional Lighting Classification	Average Maintained Illuminance (low pedestrian area)	Maximum Uniformity Ratio
Major/Major	2.6	3.0
Major/Collector	2.2	3.0
Major/Local	2.0	3.0
Collector/Collector	1.8	4.0
Collector/Local	1.6	4.0
Local/Local	1.4	6.0

The luminaires will also provide a full cutoff light distribution to reduce the negative effects of casting light on nearby properties (especially residences) and illuminating the night sky. To minimize the trespass of light on adjacent properties and reduce glare, luminaires are to be installed 30 feet above the pavement and fixtures in certain areas will have backlight control optics.

All luminaire poles and light fixtures within the project area will be removed with the exception of the CEA light on the wood pole at the intersection of Northwood Street and Tasha Drive. A new continuous lighting system with LED luminaires will be installed to meet minimum illumination requirements.

7.0 General Design Considerations

7.1 Right-of-Way Acquisition and Temporary Construction Permits

A key element for the successful completion of any project is the acquisition of any required ROW, easements, and/or permits while providing fair and equitable treatment to all affected property owners, tenants, and lessees. Individual parcel's acquisition details are determined on a case-by-case basis and negotiated privately between the MOA and the property owner.

In general, public use easements (PUE) are required in areas where the footprint of the improvements exceeds the ROW. Slope easements (SE) are required for areas where the cut and fill slopes are outside of the ROW and need to be maintained. Storm drain easements (DE) are required for drainage facilities installed on or near private property. Temporary construction permits (TCP) are required on private properties for matching new driveway grades to existing driveway grades, installation of storm drain footing services or water key boxes at the property line, and the relocation, removal or repair of improvements such as mailboxes, curbs, landscaping, fencing, and encroaching structures. Temporary construction easements (TCE) allow contractors temporary access onto private property to construct improvements that are within the ROW but where there is insufficient space within the ROW or an existing easement to conduct the work.

7.2 Driveways

Driveways will typically be repaved 8 feet beyond the back of curb to accommodate the transition insulation, which extends 4 feet beyond the roadway insulation. Concrete driveways will be constructed to match at existing seams when possible.

7.3 Mailboxes

Individual mailboxes will be impacted by the proposed improvements. Some past projects have attempted to change mail delivery from individual mailboxes to cluster mailboxes. Previous communication with the United States Postal Service (USPS) indicates that to change from individual to cluster mailboxes the following must occur:

- Every affected resident must agree to the change from individual mailboxes to cluster. If even one resident doesn't agree, the mailboxes cannot be switched to cluster style. To officially make the change in mail service, a signed concurrence from each owner is required.
- MOA is required to purchase the cluster mailboxes and install concrete foundations.

From past PM&E project experiences, it is very difficult to gain concurrence from all affected residents, thus this project plans to re-install individual mailboxes. Individual mailboxes can be re-used where feasible. If the existing mailboxes do not meet current postal standards, they will be replaced with new boxes that meet current standards.

7.4 Private Improvements in Right-of-Way

Property owners who have personal improvements in the ROW, such as landscaping, have the option of applying for encroachment permits for the improvements, removing them at their own expense, or allowing the corrective action to be incorporated into the project design. Encroachment permits for fences and retaining walls within the roadway clear zone are usually not granted. Fences within the ROW for this project will be removed and reset onto the property line if impacted during construction. If an owner doesn't wish for the fence to be reset, it will be disposed.

8.0 Roadway Design Alternatives

To correct the poor condition of the roadway surfacing and irregular curbs, the roadway structural section should be replaced. Vertical profile adjustments are anticipated to improve driveway slopes, drainage, and promote positive stormwater flows to the new storm drain system. Details of the roadway design elements are discussed below. Roadway plan and profile drawings depicting the conceptual improvements can be found in APPENDIX B.

8.1 Project Specific Design Challenges

Some of the significant roadway design challenges associated with the Tasha Drive project include:

- There are 25 single-family homes in the project area with some driveways located closely together. The closely spaced driveways limit available snow storage.
- Many of the driveways have no landings, grades steeper than maximum allowable grade of 10%, or have negative slopes back toward the ROW.
- Roadway grades very from about 4% to flat and there are known surface drainage issues in the project area.
- Residents may perceive the grassed ROW area in front of their house as part of "their front yard." Reconstructing the roadway and impacting those improvements, may be perceived as impacting private property. Also, many private improvements extend into the ROW.

Existing Driveway Sloping Towards ROW

8.2 No Build Alternative

The No-Build alternative would make no improvements to the roadway corridors. Because improvements to the corridor are supported by stakeholders and the No Build Alternative does not meet the project goals of improving safety and drainage, it was not further considered in this report.

8.3 Roadway Cross Section

8.3.1 Alternative 1

For Alternative 1, the proposed roadway width would be 33 feet measured from the back of curb and have rolled curb. The structural section will adhere to the geotechnical recommendations discussed in Section 5.0. See FIGURE 2 below for the proposed roadway typical section. No roadway traffic markings are proposed for Alternative 1, effectively allowing parking along either side of the roadway. Additionally, Alternative 1 will allow for a clear space behind the back of curb for snow storage.

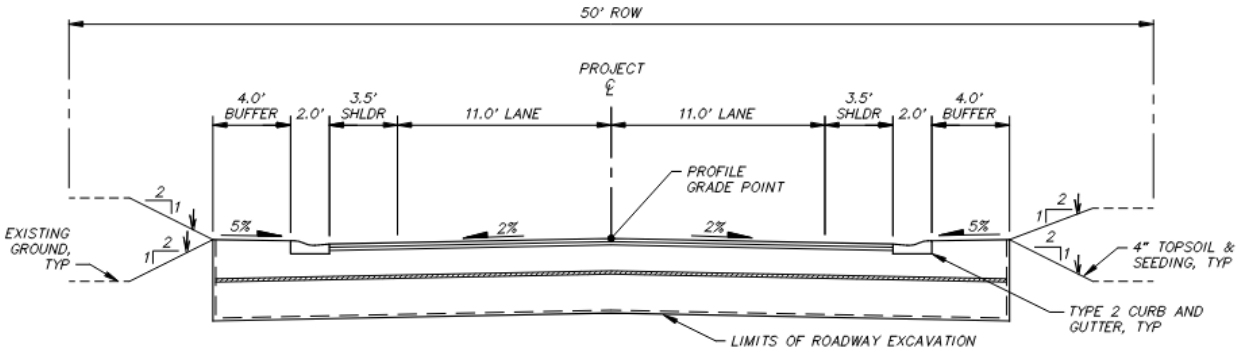


Figure 2 – Roadway Typical Section

8.3.2 Alternative 2

Similar to Alternative 1, Alternative 2 would have a roadway width of 33 feet measured from back of curb and have a rolled curb. However, this alternative would also have an attached sidewalk on one side of the roadway. Similar to Alternative 1, no roadway markings are proposed for Alternative 2, effectively allowing parking along the roadway.

8.3.3 Analysis and Recommended Alternative

A questionnaire was sent to the residents of Tasha Drive, including a question asking what the top three things are that the residents would change about Tasha Drive. Residents identified improved drainage, roadway resurfacing, and roadway lighting as the top responses. Pedestrian facilities were not mentioned by any of the residents as a potential need.

Although Tasha Drive is located within the walking route boundary for the local elementary school (Chinook Elementary) and local high school (Dimond High School), Tasha Drive is not shown as a preferred walking route. Pedestrians and school children all have access to the existing sidewalks and pathways on West 88th Avenue and Northwood Street. These adjacent facilities essentially link both ends of Tasha Drive and provide well-established, nearby pedestrian facilities.

The addition of an attached sidewalk would have adverse effects on existing driveways. Some of the current driveways along Tasha Drive do not currently meet MOA standards. Some driveways have slopes as steep as 18% and others currently slope away from the roadway towards the ROW.

The Alternative 1 roadway design will address the residents' concerns by resurfacing the roadway, adding subdrain system to alleviate ground and surface water, and improving lighting within the project corridor. Improving the roadway section will reduce maintenance needs and still provide addition clear space behind the curb for snow storage. Alternative 1 provides a balanced approach to fit the context of the community while maintaining the safety goals of the project and thus, Alternative 1 is the recommended alternative.

8.4 Horizontal Alignment

The horizontal roadway design for Tasha Drive and Kathleen Drive are proposed to be centered within the ROW, however, Kathleen Street intersects Tasha Drive at skewed angle of 80 degrees. The two horizontal curves along Tasha Drive each have a radius of 150 feet, which is the minimum required per the DCM.

8.5 Vertical Alignment

The overall intent of the roadway profile is to maintain adequate grades for drainage along the project corridor while minimizing adverse effects on surrounding driveways, side streets, and infrastructure. The more the proposed roadway grade is changed from the existing grade, the more the cut and fill slopes will impact adjacent properties. Driveways and side streets must also be adjusted to match the new roadway grades. The proposed conceptual roadway profile is shown in APPENDIX B.

9.0 Drainage Design Alternatives

One of the primary goals for this project is to improve overall drainage in the project area and upgrade the deteriorating roadway. This will be accomplished by several drainage improvements consisting of the following:

- Provide a continuous piped subdrain system along Tasha Drive from Flamingo Drive to Northwood Street.
    - Perforated subdrain pipe will help lower the high groundwater, resulting in a longer lasting and better performing roadway
- Design high/low points in flat segments of Tasha Drive to provide positive drainage throughout the project corridor
- Install catch basins at new roadway low points to intercept storm and spring runoff to minimize ponding/flooding
- Provide footing drain service stubs to each property to allow residents to connect their sump pumps to alleviate groundwater/runoff into crawl spaces and low lying areas on property

The proposed storm drain system as described in SECTION 9.1.1 below is shown on the plan and profile sheets in APPENDIX C.

9.1 Proposed Conditions

Two alternatives were evaluated for the proposed storm drainage system. The first option consisted of installing perforated storm drain pipe below each side of the new curb to intercept as much groundwater as possible. However, after evaluating this option, it was determined not feasible due to conflicts with existing water and sewer utilities and maintaining required separation distance from these utilities. The second alternative is discussed in detail below.

9.1.1 Conveyance Systems

As noted in SECTION 4.1.1, Tasha Drive currently does not have any storm drain infrastructure from Flamingo Drive to Northwood Street except for two curb inlets located just west of Northwood Street. These structures are relatively ineffective at collecting runoff due to poor and/or flat roadway grades upstream of these structures.

The proposed subdrain system consists of extending a continuous gravity subdrain system along Tasha Drive from Flamingo Drive to the east and connect to the existing system on Northwood Street (Manhole 32327-174). A combination of the curb inlets and manholes are located to collect runoff at low and intermediate points along Tasha Drive and direct the flow to the gravity piped system. The piped system will be constructed with corrosion resistant CPEP (plastic) pipe ranging in size from 12-inches (catch basin leads) to 18-inches (main line pipe). All pipes will be perforated to allow groundwater into the system, effectively decreasing the amount of water within the roadway structural section. The main line pipe is routed near the centerline of the roadway and maintains the required separation distance from the water and sewer mains.

A questionnaire was created by the project team to gather specific input from residents along the Tasha Drive. One of the questions asked is if the resident experiences groundwater issues in the crawl space or basement. Of the fifteen responses, 9 (60%) stated “yes”. A follow up question asked if the resident used a foundation drain or sump pump. Ten (67%) out of the fifteen responses indicated that a sump pump or foundation drain was being utilized. Based on these responses and the high groundwater identified during the geotechnical analysis, it is recommended that footing drain service stubs be included in the scope of this project. Residents can connect sump pumps to the footing drain service stub that will extend from the proposed storm drain to property line.

9.1.2 Contributing Drainage Area

Ineffective Catch Basin / Ponding Upstream

The contributing drainage area and drainage patterns for the proposed condition remains mainly unchanged from the existing conditions identified in SECTION 4.1.2. Stormwater from adjacent properties will be routed towards Tasha Drive where new curb and gutter will convey runoff to the proposed storm drain system.

While the overall contributing drainage area remains the same, the existing catchment areas were modified to reflect the addition of the proposed catch basins located at designed low points and intermediate locations along Tasha Drive. This was done to properly size the new subdrain pipe based on where flows enter the system. For the proposed condition, a total of eight catchments were delineated. See FIGURE 4, APPENDIX K for a map showing these catchments and peak runoff generated from each area.

9.1.3 Water Quality Treatment

The Tasha Drive Reconstruction project is reconstructing an existing roadway corridor with a ROW width of 50 feet. Per Section 3.3.2.1 of the ASM, roadway projects with ROWs of 60 feet or less can choose to provide water quality treatment using green infrastructure or traditional treatment such as an OGS. The project corridor along Tasha Drive consists of a fully developed residential neighborhood with insufficient area to implement green infrastructure, challenging grading for steep driveways, and high groundwater. For these reasons, traditional treatment was selected.

All proposed catch basins and manholes will be constructed with sumps to collect course sediment and debris. Traditional treatment is planned by utilizing the existing OGS located downstream of the proposed manhole connection point as discussed in SECTION 4.1.3. Further treatment is provided as runoff flows through the vegetated swale prior to discharging into Campbell Creek. CRW will contact MOA Street Maintenance during the design phase to verify that the existing OGS and swale are providing adequate water quality treatment. If MOA Street Maintenance deems the existing treatment is not sufficient for the contributing runoff from Tasha Drive, a new OGS and bypass system will be designed upstream of the planned Northwood Street connection.

9.1.4 Freeze Protection

The proposed subdrain will be constructed with a minimum of 4 feet of cover as measured from the street surface to the top of pipe for freeze protection. The proposed roadway structural section also includes insulation board (R-9), providing additional protection.

9.2 Hydrologic and Hydraulic Analysis

The hydrologic and hydraulic analysis methodology, design storms, and distribution used for the existing condition was also used for the proposed condition. Refer to SECTION 4.2 for additional information.

9.2.1 Model Results

The results from the drainage modeling effort show that the proposed subdrain along Tasha Drive is adequately sized to convey both the 10- and 100-year storm events without surcharging. Refer to the profiles provided in APPENDIX K illustrating water surface elevations in the proposed system during each of the design storm events. Peak flows are shown below for runoff entering the Northwood Street and W. 88th Avenue for the 10-year and 100-year storm events.

Table 6 - Peak Flows (Proposed Conditions)

Design Point (MOA GIS ID)	Peak Runoff 10-yr, 24-hr Event (cfs)	Peak Runoff 100-yr, 24-hr Event (cfs)
Northwood Street (32327-174)	2.11	5.26
W. 88th Avenue (32327-037)	0.75	1.91

Comprehensive drainage model results, input parameters, and other related data can be referenced in APPENDIX K. Note that the naming convention used for the storm drain structures and pipe in the proposed drainage model and in the table above match the MOA HGDB mapping identification number and Storm Drain Plan & Profile sheets in APPENDIX C.

10.0 Right-of-Way Impacts

Preliminary estimated easement and permit requirements are summarized in TABLE 7 below and are detailed in APPENDIX H. As the planning and design of this project progresses, the required easements and temporary construction permits will be refined.

Table 7 – Estimated Right-of-Way Easements / Permits

Public Use Easements (PUE)	Slope Easements (SE)	Drainage Easements (DE)	Temporary Construction Easements (TCE)	Temporary Construction Permits (TCP)
-	1	-	-	26

11.0 Utility Impacts

When reconstruction projects are made in urban areas, impacts to utilities need to be analyzed. Existing utility facilities are shown in APPENDIX A. For safety, overhead and underground clearances must be maintained.

In the ROW, the Municipality requires a minimum burial depth of 42 inches for buried gas lines, electric cables, fiber optic lines, telephone cables, and cable television lines. For the purpose of this report, it is assumed that the existing buried facilities in the project area are buried at the minimum depth. As a result, any reduction of cover will require relocation of the facility. If there are conflicts with the proposed storm drain improvements, utilities will either require relocation or will require support in place for the contractor to work around the utility.

Utility impacts and associated estimated relocation costs are included in the construction cost estimate.

12.0 Permitting & Easement Requirements

Permits and agency approvals required for construction of the proposed improvements will be limited. Because the roadway is classified as a secondary (local) urban residential road, it is not necessary to obtain approval of the DSM from the MOA Planning and Zoning Commission or the MOA Urban Design Commission. Anticipated permits and agency approvals required for this project include:

- ADEC Approval to Construct Storm Drain Improvements and Separation Waivers
- Construction General Permit (required from ADEC for any ground-disturbing activities over 1 acre where storm water runoff from the project discharges into water of the U.S. or an Municipal Separate Storm Sewer Systems [MS4])
- Department of Natural Resources (DNR) Temporary Water Use Permit for dewatering
- MOA Watershed Management Services Stormwater Plan Approval
- MOA Traffic Department for review and concurrence
- PM&E review and concurrence
- ROW Permit

Additional permits may be identified as the design develops.

13.0 Stakeholder Coordination/Public Involvement

Using the MOA Context Sensitive Solutions (CSS) process, the project team began public and agency outreach in March 2021. The goal of the CSS process is to collaborate with all stakeholders to improve the safety and accessibility of the project area, balance diverse community interests, and to find areas of compromise that address budget and environmental concerns. The table below shows a list of the stakeholders.

Table 8 – List of Stakeholders

MOA Agencies	Other
Project Management & Engineering Traffic Engineering Planning Transit AWWU Solid Waste Services Anchorage Fire Department Street Maintenance Anchorage Police Department Mayor's Office Assembly Anchorage School District	Area property owners, property managers, and residents Sand Lake Community Council Alaska Communications Systems (ACS) GCI Chugach Electric ENSTAR

A. Stakeholder Involvement Activities

Distribution of project information included a combination of a project-specific website, mailed postcards, Sand Lake Community Council meetings, and mailed questionnaires sent to residents along the project corridor. A project website (www.TashaDriveReconstruction.com) has been developed for ease of project information sharing and soliciting comments from the public. Website content includes a project overview, how to get involved, recent project news, map of the project area, and a sign up for the project mailing list. Copies of the mailing area, announcements, and other communications are included in the APPENDIX I.

B. Summary of Comments Received

A questionnaire was created by the project team to gather specific input from residents about the project area; 15 people completed and returned the questionnaire. Copies of the residents' comments can be found in APPENDIX I.

14.0 Quantity and Cost Estimates

A summary of estimated project costs for the proposed improvements is presented below for Alternative 1. Detailed cost estimates can be found in APPENDIX H.

Table 9 – Summary of Estimated Project Costs

Category	Alternative 1 (Recommended)
Design & Management Total (estimated)	$942,860
ROW Acquisition Total	$20,000
Utility Relocation (15% Contingency) Total	$292,000
A. Design, ROW Acquisition, Utility Relocation	**$1,254,860**
Construction	
Drainage & Roadway Improvements	$1,857,338
Construction Contingency (15%)	$279,000
Construction Management / Inspection / Testing	$208,022
B. Total Estimated Construction Cost (rounded)	**$2,344,360**
C. Overhead / Grant Accounting	**$635,156**
Total Estimated Project Cost (A + B + C)	**$4,234,376**

15.0 Design Recommendations

Based on comments received from public, agency, and business stakeholders and requirements of MOA Title 21, and DCM, the preferred alternatives for the project corridor are as follows:

A. Roadway

Alternative 1 is the preferred alternative for Tasha Drive with two, 11-foot wide travel lanes with 3.5-foot wide shoulders and rolled (Type 2) curb and gutter. This is the recommended alternative because it minimizes impacts to adjacent properties while still providing improved drainage and roadway facilities.

B. Drainage

A new piped storm and sub-drain system should be installed along Tasha Drive and tie into the existing Northwood Street storm drain system. Footing drain stub outs will be connected to the proposed storm drain and placed at each property line for residents to connect existing crawlspace sump pumps.

C. Other Recommended Improvements

- Roadway Markings: No centerline or shoulder markings are proposed along Tasha Drive (a local road), but a stop bar will be installed at the intersection of Tasha Drive and Northwood Street.
- Roadway Horizontal and Vertical Alignment: The project roadways will typically follow the center of the ROW. The proposed profile for Tasha drive will force high/low spots by raising and lowering the roadway grades to improve drainage.
- Design and Posted Speed Limit: The proposed recommendation is to maintain the current posted speed limit of 25 MPH. A design speed of 25 MPH is proposed.
- Lighting: Continuous LED lighting system, consistent with current MOA standards, will be installed along the roadway.
- Landscaping: Proposed landscaping will be in character with the adjacent residential properties. Existing landscaping will be maintained where practical to preserve the benefits of mature landscaping (ex. habitats, storm water capture) but will be pruned or include selective removal as needed to provide clear sight lines and required snow storage.

D. Proposed Variances from Design Criteria Manual

The proposed variances from the DCM and Title 21 for this project will be submitted for approval under a separate document during the design process. There are several design criteria that may not be able to meet the MOA DCM or Title 21 requirements. Below is a list of potential variances for this project for the preferred alternative; additional variances may be required as the design progresses:

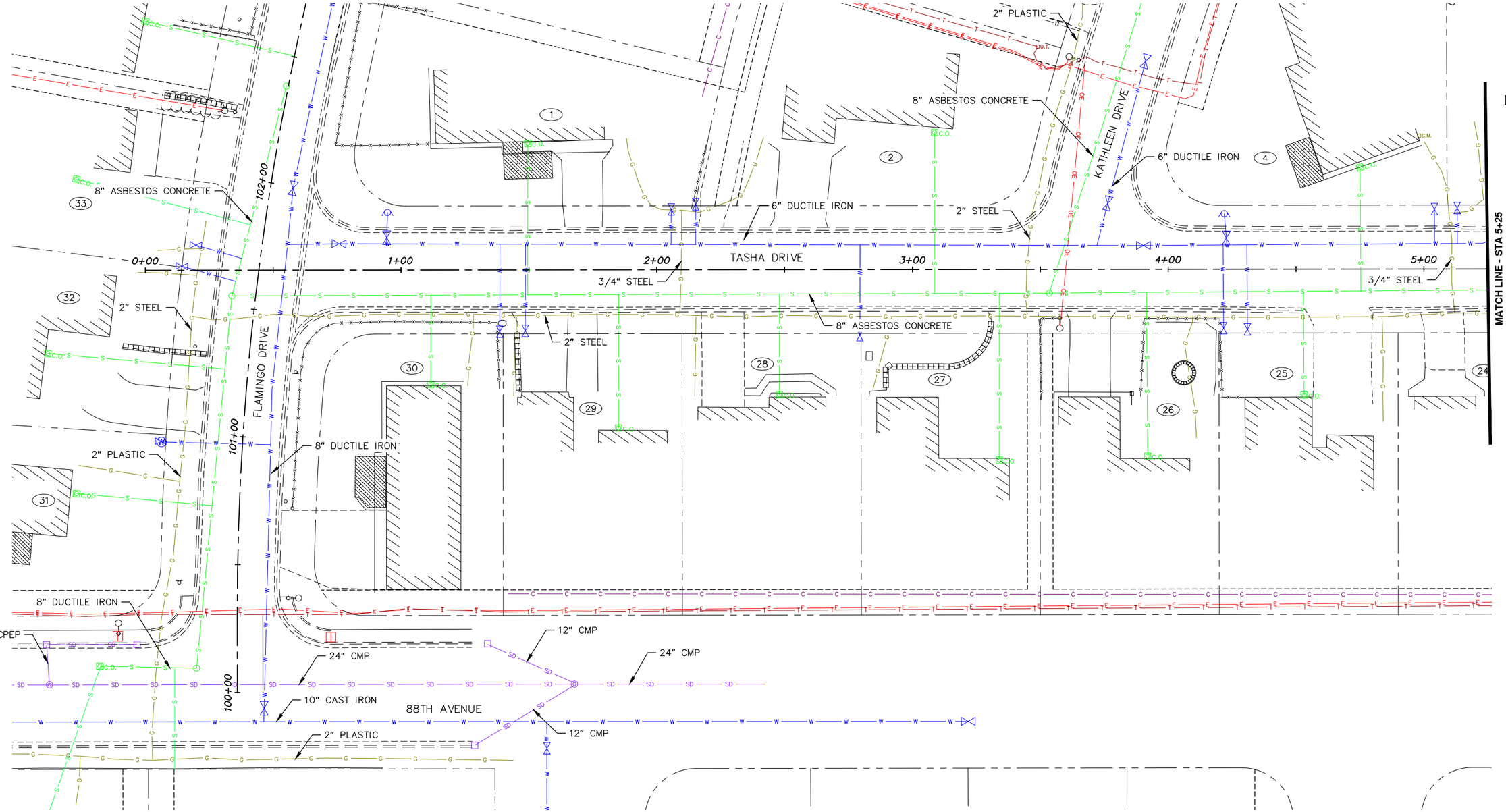
- Driveway landings and grades – The DCM requires that residential driveways have a minimum 12-foot landing length and a maximum grade of ±10%. The grade of the landings must be 2% maximum.
    - Some of the driveways will not be able to meet these landing or grade requirements due to existing infrastructure and grades.
- Sidewalk – AMC Title 21 (AMC 21.07.060E.2) requires sidewalks to be installed on both sides of the street.
    - The existing 50-foot ROW and steep driveway grades prevents the installation of a sidewalk. The installation of a sidewalk would result in steeper driveway grades and roadway improvements outside of the Right of Way.
- Curb Return Radii – Figure 1-22 in the DCM calls for a 30-foot radius when a residential street meets an arterial or collector street.
    - The existing curb return radii at the intersection of Northwood Street and Tasha Drive are 20-feet. Updating the curb return radii to 30-feet would result in proposed improvements outside of the ROW, requiring permanent easements. Additionally, the existing Northwood Street light pole would require relocation. MOA crash data from 2016-2021 was reviewed for the entire project corridor and no crashes were

reported in the project corridor during this time. The design proposes to keep the existing curb return radii at 20-feet, to match existing.

****** End of Report ******

Existing Utilities Drawings

Appendix A



EXISTING UTILITY LEGEND

- SANITARY SEWER
- NATURAL GAS
- WATER
- STORM DRAIN
- FIBER OPTIC
- CABLE TELEVISION
- CABLE TELEVISION (OVERHEAD)
- TELEPHONE
- TELEPHONE (OVERHEAD)
- ELECTRIC
- ELECTRIC (OVERHEAD)
- ELECTRIC/CABLE (OVERHEAD)
- ELECTRIC/TELEPHONE/CABLE (OVERHEAD)
- ABANDON ELECTRIC LINE
- GRAVEL
- CURB & GUTTER

- EDGE OF PAVEMENT
- PROPERTY LINE
- EASMENT
- CONCRETE
- RETAINING WALL
- SANITARY SEWER MANHOLE
- SANITARY SEWER SERVICE
- SANITARY SEWER CLEANOUT
- KEY BOX / WATER VALVE
- FIRE HYDRANT
- WELL
- WATER VENT
- STORM DRAIN CATCH BASIN
- STORM DRAIN MANHOLE
- STORM DRAIN CATCH BASIN MANHOLE
- FIBER OPTIC VAULT

- CABLE PEDESTAL
- TELEPHONE PEDESTAL
- GAS METER
- FUEL VENT
- ELECTRIC JBOX
- ELECTRIC SWITCH CABINET
- LUMINAIRE
- LIGHT POLE
- POWERLINE POLE
- GUY WIRE
- LOAD CENTER
- JUNCTION BOX TYPE 1
- ELECTRIC MANHOLE
- ELECTRIC OUTLET

- SATELLITE DISH
- PARCEL NUMBER

20' 0 20' 40'

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
CONSULTANT

MUNICIPALITY OF ANCHORAGE

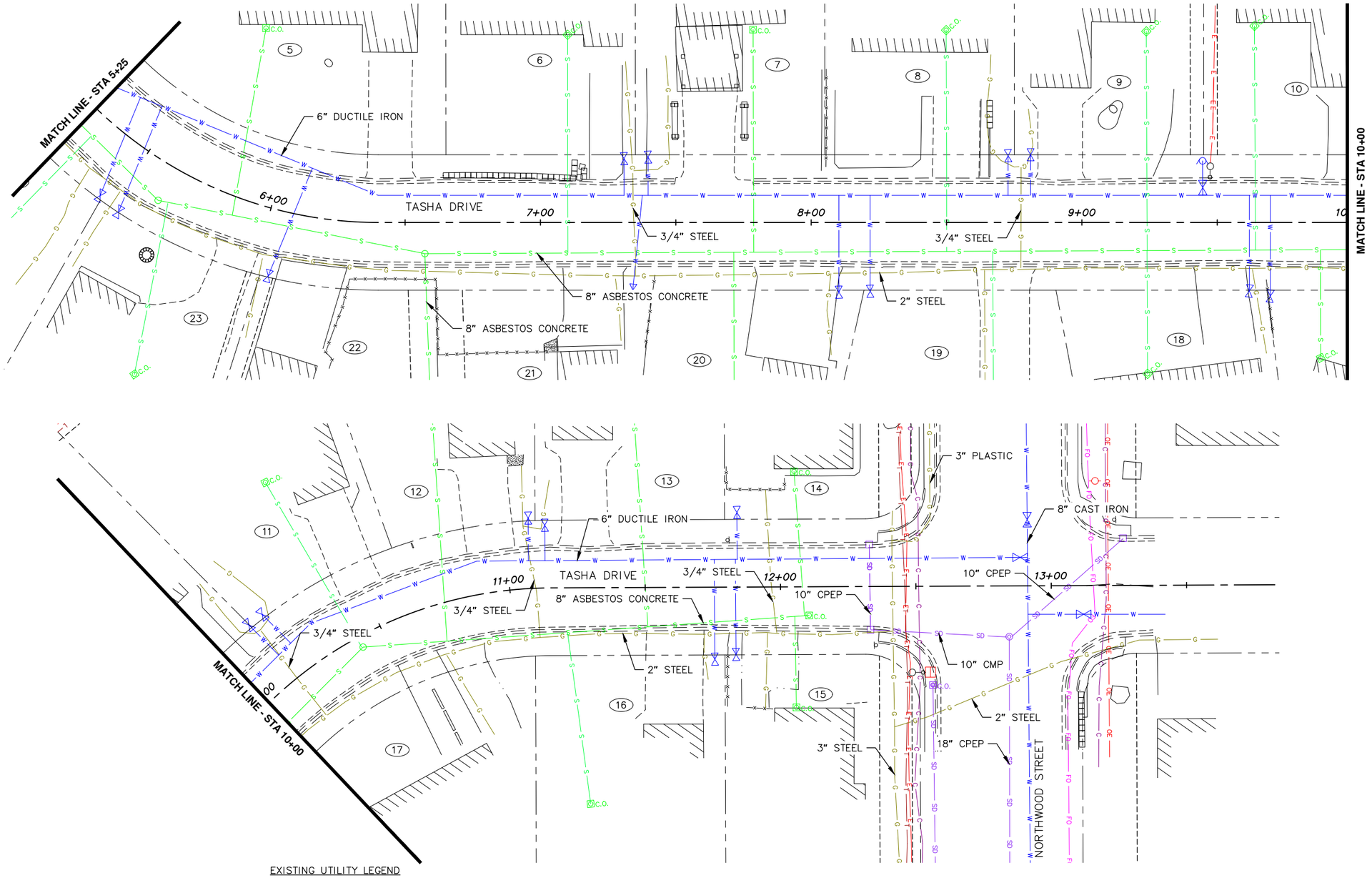
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

TASHA DRIVE RECONSTRUCTION
FLAMINGO DRIVE TO NORTHWOOD STREET

EXISTING UTILITIES

SCALE HOR. 1"=20'
VER. N/A
GRID SW2327, SW2328
DATE SEP 2022
STATUS DRAFT
SHEET A1 of A2

File: J:\Jobs\Data\10150.00 Tasha Drive Reconstruct\00 CADD 2019\02 Figures\06 UCR\Appendix A_Existing Utilities.dwg



EXISTING UTILITY LEGEND

- SANITARY SEWER
- NATURAL GAS
- WATER
- STORM DRAIN
- FIBER OPTIC
- CABLE TELEVISION
- CABLE TELEVISION (OVERHEAD)
- TELEPHONE
- TELEPHONE (OVERHEAD)
- ELECTRIC
- ELECTRIC (OVERHEAD)
- ELECTRIC/CABLE (OVERHEAD)
- ELECTRIC/TELEPHONE/CABLE (OVERHEAD)
- ABANDON ELECTRIC LINE
- GRAVEL
- CURB & GUTTER

- EDGE OF PAVEMENT
- PROPERTY LINE
- EASMENT
- CONCRETE
- SANITARY SEWER MANHOLE
- SANITARY SEWER SERVICE
- SANITARY SEWER CLEANOUT
- KEY BOX / WATER VALVE
- FIRE HYDRANT
- WELL
- WATER VENT
- STORM DRAIN CATCH BASIN
- STORM DRAIN MANHOLE
- STORM DRAIN CATCH BASIN MANHOLE
- FIBER OPTIC VAULT

- CABLE PEDESTAL
- TELEPHONE PEDESTAL
- GAS METER
- FUEL VENT
- ELECTRIC JBOX
- ELECTRIC SWITCH CABINET
- LUMINAIRE
- LIGHT POLE
- POWERLINE POLE
- GUY WIRE
- LOAD CENTER
- JUNCTION BOX TYPE 1
- ELECTRIC MANHOLE
- ELECTRIC OUTLET

- SATELLITE DISH
- PARCEL NUMBER

20' 0 20' 40'

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
CONSULTANT

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

TASHA DRIVE RECONSTRUCTION
FLAMINGO DRIVE TO NORTHWOOD STREET

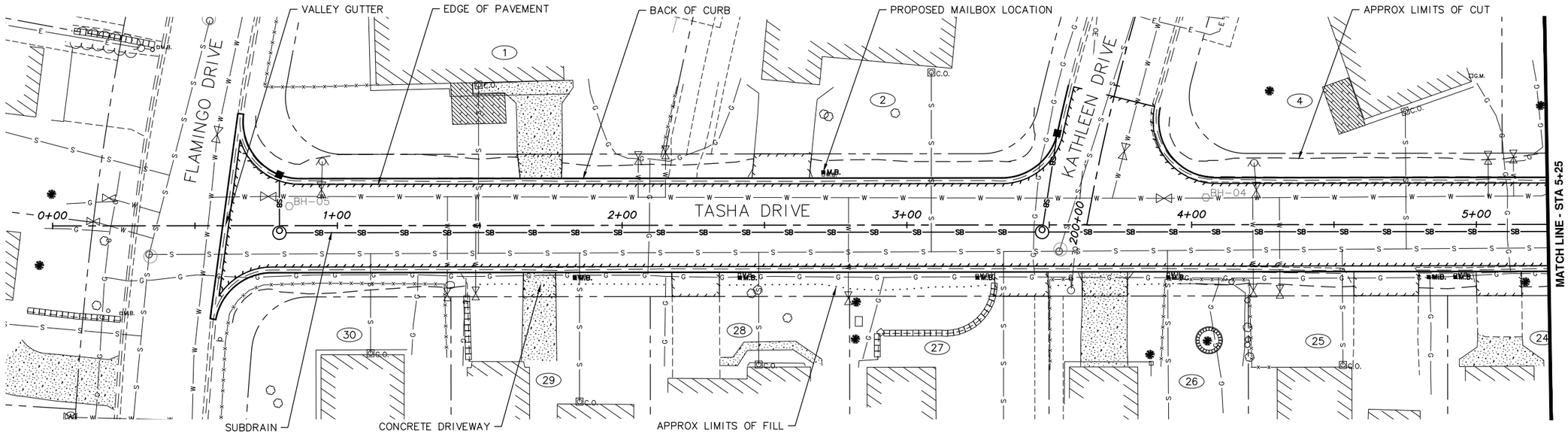
EXISTING UTILITIES

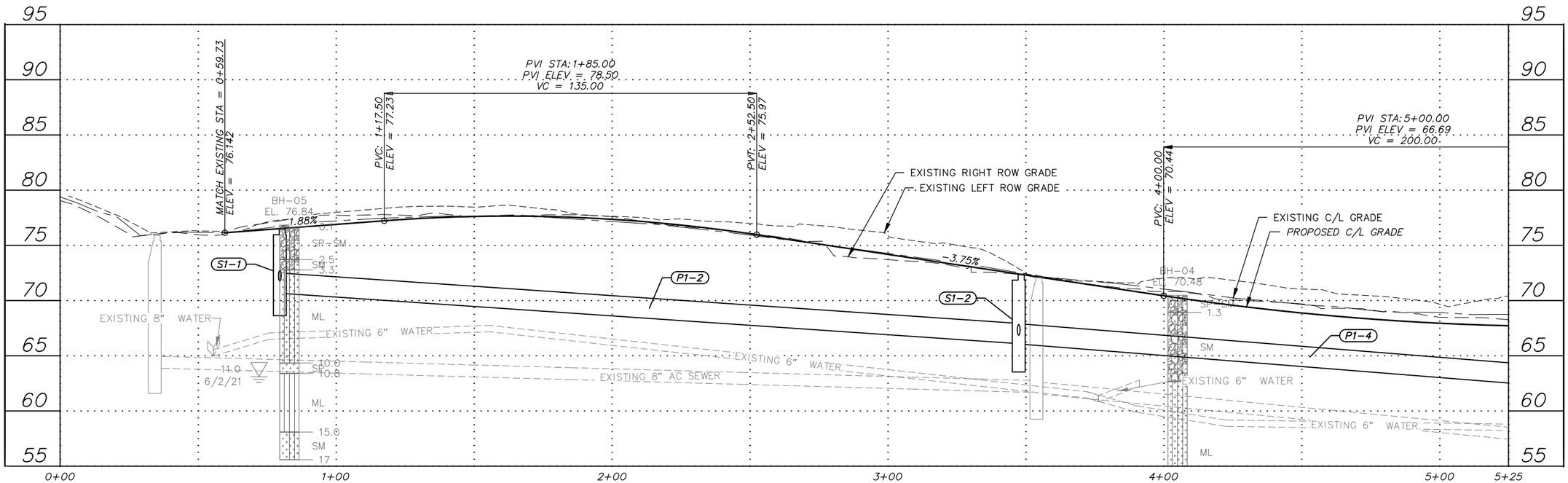
SCALE	HOR. 1"=30'	GRID SW2327, SW2328		
	VER. N/A	DATE SEP 2022	STATUS DRAFT	SHEET A2 of A2

File: J:\Jobs\Data\10150.00 Tasha Drive Reconstruct\00 CADD 2019\02 Figures\06 UCR\Appendix A_Existing Utilities.dwg

Roadway Plan & Profile Drawings

Appendix B





RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
2. DATA TRANSFERRED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
   BY: _____

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		

PLAN CHECK

GRAPHIC 40 20 0 20 40 SCALE

FIELD BOOKS	BM NO.	LOCATION	ELEV.
DESIGN			
STAKING			
ASBUILT			
CONTRACTOR	BASIS OF THIS DATUM		
INSPECTOR			

CONSTRUCTION RECORD | VERTICAL DATUM

REV	DATE	DESCRIPTION	BY

REVISIONS

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
@ECL882-AK

CONSULTANT | SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

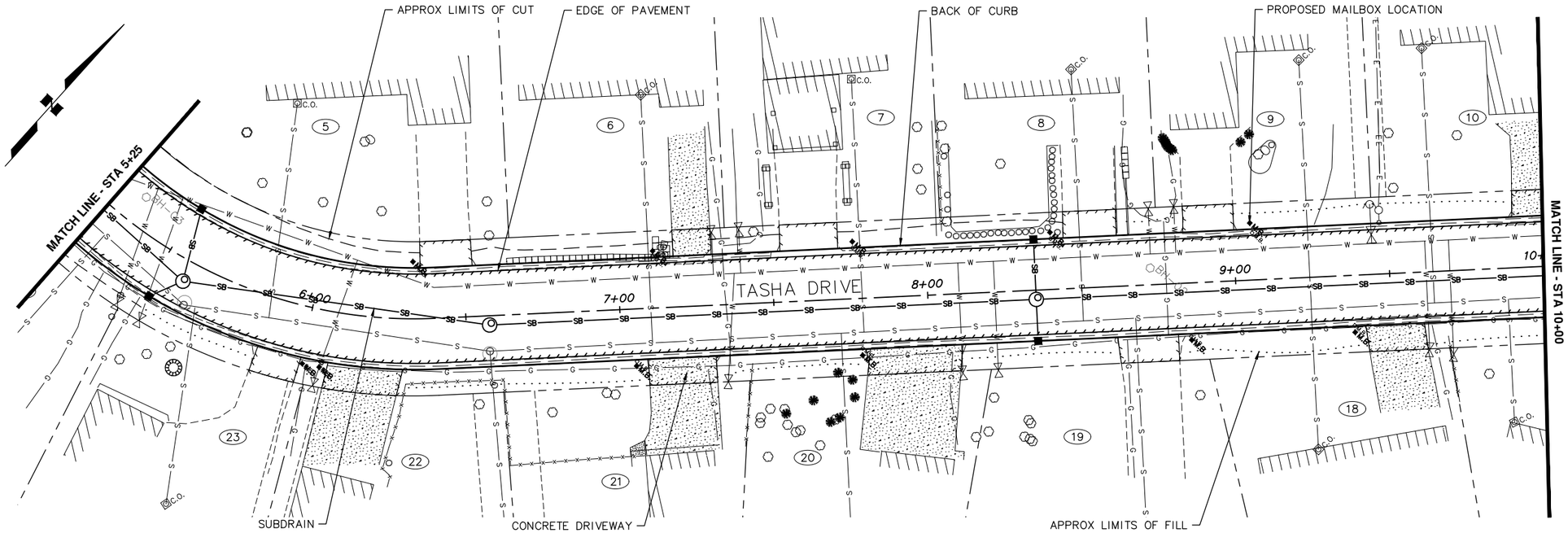
20-15 TASHA DRIVE RECONSTRUCTION SCHED A

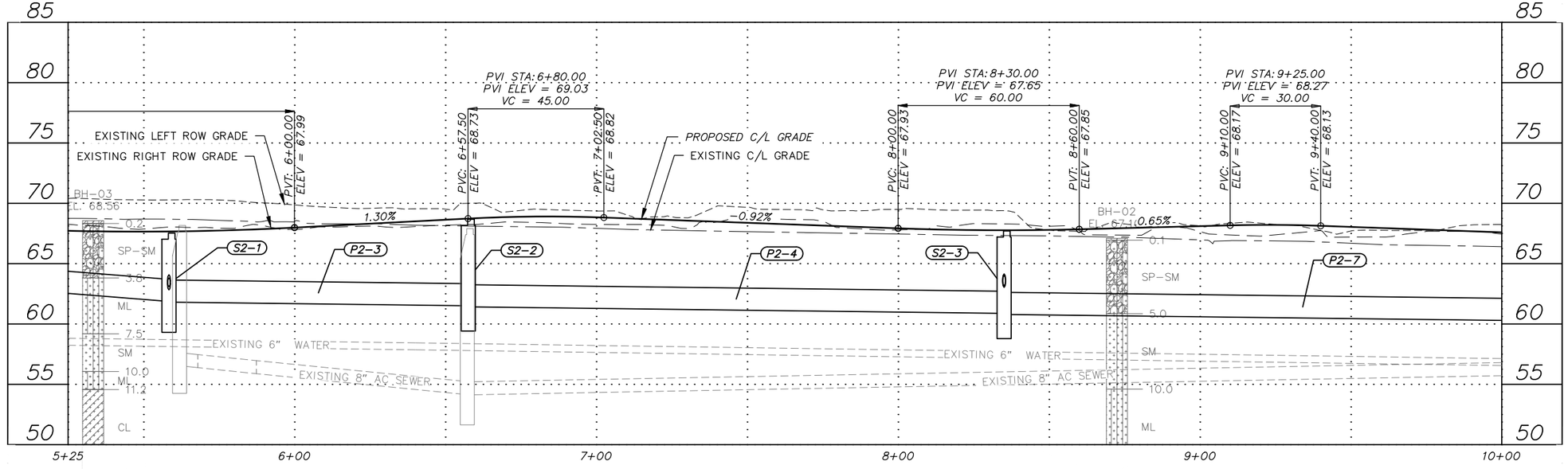
ROADWAY PLAN & PROFILE

TASHA DRIVE
BOP TO STA 5+25

SCALE HOR. 1"=20' VER. 1"=5' | GRID 2327 | DATE OCT 2022 | STATUS 35% | SHEET R1 of R6

File: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Roadway.dwg





RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
2. DATA TRANSFERRED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
   BY: _____

PLAN CHECK

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		

GRAPHIC SCALE 40 20 0 20 40

CONSTRUCTION RECORD

FIELD BOOKS	BM NO.	LOCATION	ELEV.
DESIGN			
STAKING			
ASBUILT			
CONTRACTOR	BASIS OF THIS DATUM		
INSPECTOR			

VERTICAL DATUM

REVISIONS

REV	DATE	DESCRIPTION	BY

CONSULTANT

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
@ACL882-AK

SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

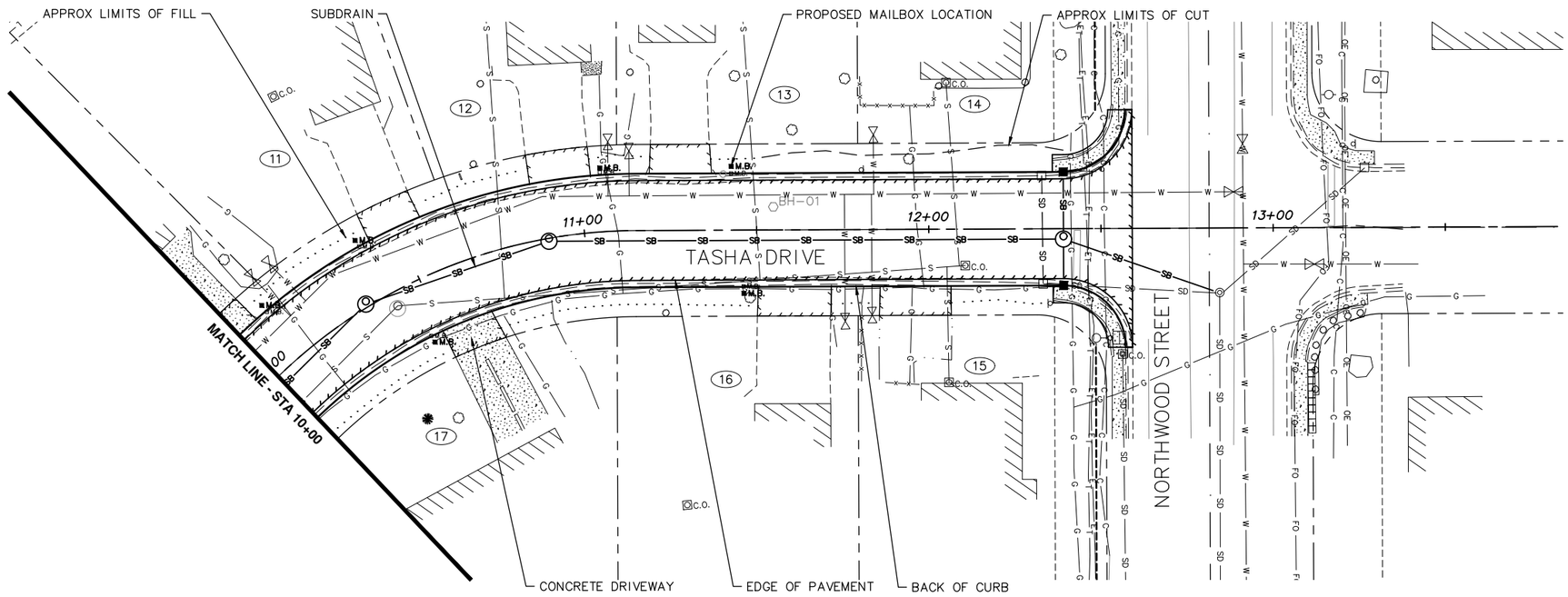
20-15 TASHA DRIVE RECONSTRUCTION SCHED A

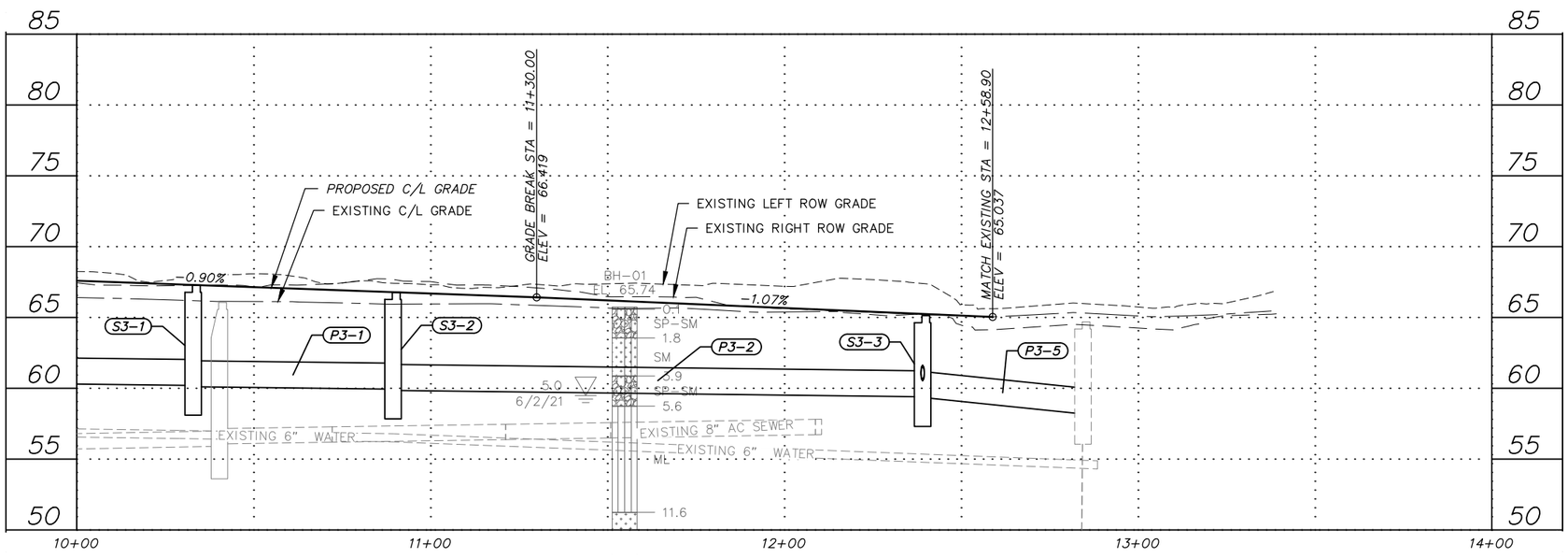
ROADWAY PLAN & PROFILE

TASHA DRIVE
STA 5+25 TO 10+00

SCALE HOR. 1"=20' VER. 1"=5'
GRID 2327
DATE OCT 2022
STATUS 35%
SHEET R2 of R6

File: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Roadway.dwg





RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
2. DATA TRANSFERRED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
   BY: _____

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		

PLAN CHECK

GRAPHIC SCALE 40 20 0 20 40

FIELD BOOKS	BM NO.	LOCATION	ELEV.
DESIGN			
STAKING			
ASBUILT			
CONTRACTOR	BASIS OF THIS DATUM		
INSPECTOR			

CONSTRUCTION RECORD | VERTICAL DATUM

REV	DATE	DESCRIPTION	BY

REVISIONS

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
@ECL882-AK

CONSULTANT | SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

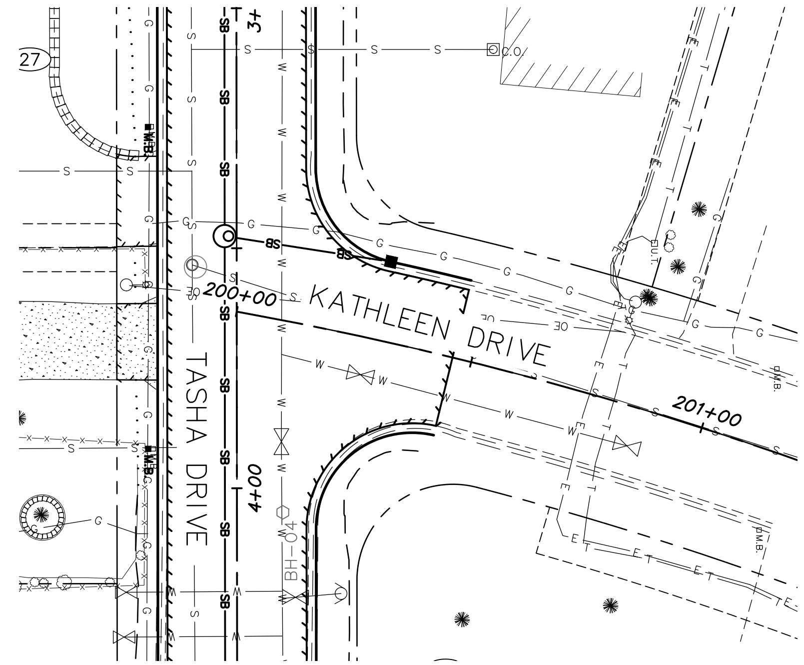
20-15 TASHA DRIVE RECONSTRUCTION SCHED A

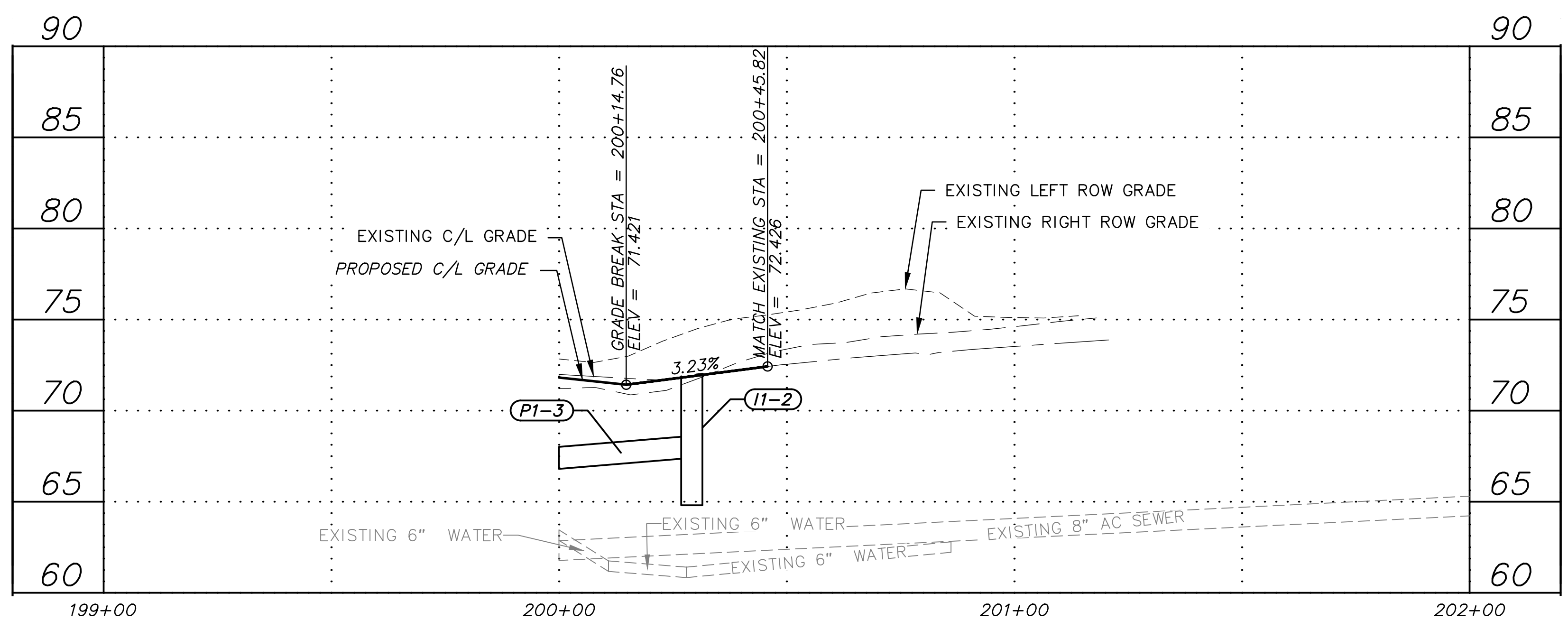
ROADWAY PLAN & PROFILE

TASHA DRIVE
STA 10+00 TO EOP

SCALE HOR. 1"=20' VER. 1"=5' | GRID 2327 | DATE OCT 2022 | STATUS 35% | SHEET R3 of R6

File: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Roadway.dwg





File: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Roadway.dwg

RECORD DRAWING

1. DATA PROVIDED BY: ____ TITLE: ____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: ____
   BY: ____ TITLE: ____ DATE: ____
2. DATA TRANSFERRED BY: ____ TITLE: ____
   COMPANY: ____ DATE: ____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: ____ TITLE: ____
   COMPANY: ____ DATE: ____
   BY: ____

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		
PLAN CHECK		

GRAPHIC SCALE 40 20 0 20 40

FIELD BOOKS	
DESIGN	
STAKING	
ASBUILT	
CONTRACTOR	
INSPECTOR	
CONSTRUCTION RECORD	

BM NO.	LOCATION	ELEV.
BASIS OF THIS DATUM		
VERTICAL DATUM		

REV	DATE	DESCRIPTION	BY
REVISIONS			

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

CONSULTANT

SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

20-15 TASHA DRIVE RECONSTRUCTION SCHED A

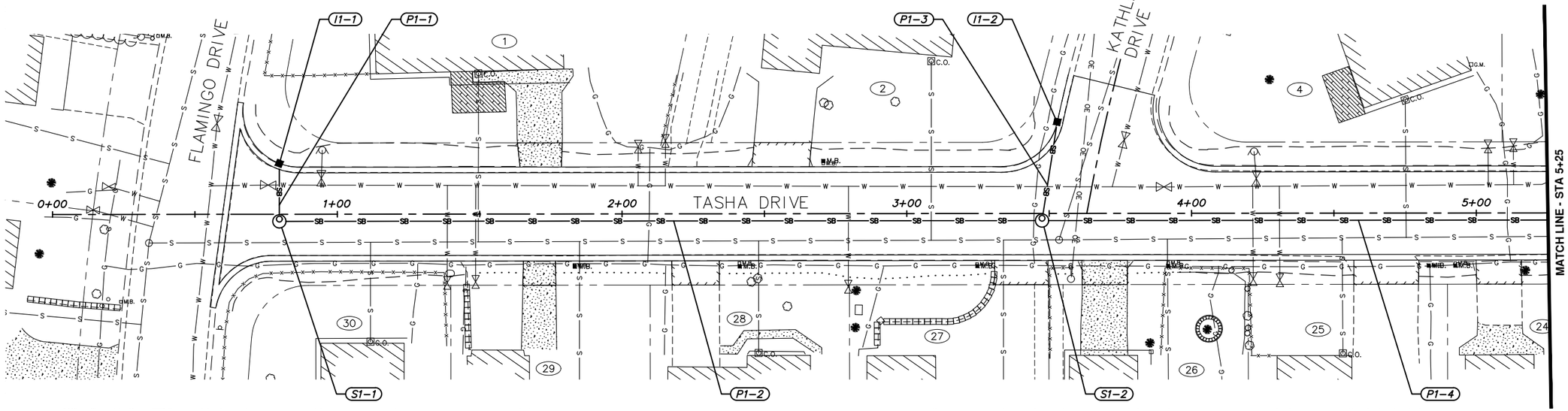
ROADWAY PLAN & PROFILE

KATHLEEN DRIVE
BOP TO EOP

SCALE HOR. 1"=20' VER. 1"=5'
GRID 2327
DATE OCT 2022
STATUS 35%
SHEET R4 of R6

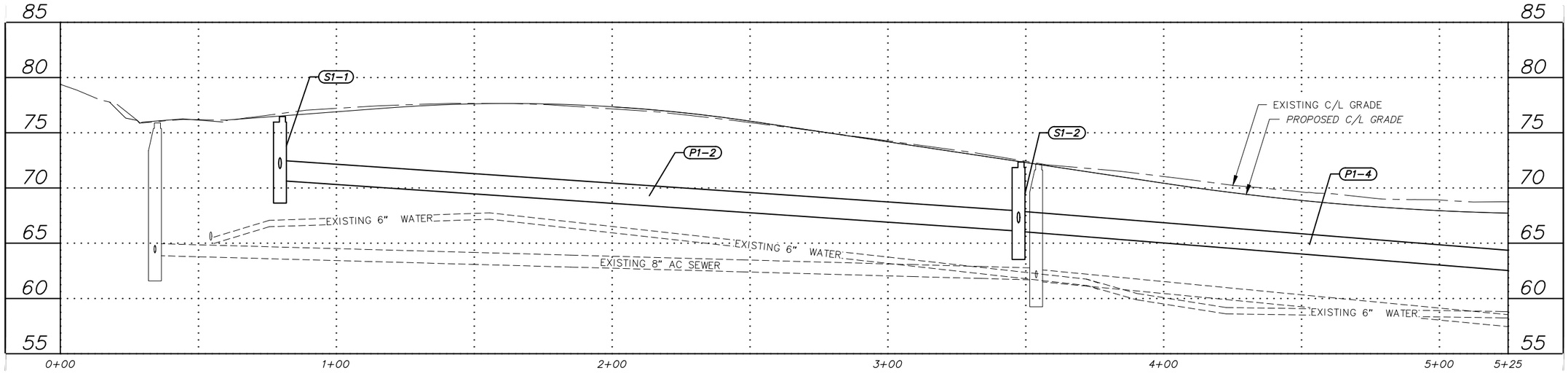
Storm Drain Plan & Profile Drawings

Appendix C



NOTES:

1. REFER TO SHEET SD4 FOR GENERAL STORM DRAIN STRUCTURE/PIPE NOTES AND STRUCTURE ABBREVIATIONS USED ON SUMMARY TABLES SHOWN ON THIS SHEET.
2. REFER TO SHEETS SD4 FOR STORM DRAIN DETAILS.
3. REFER TO SHEETS SD5 FOR STORM DRAIN SUMMARY TABLES.
4. FOOTING DRAIN SERVICES NOT SHOWN. FOOTING DRAIN SERVICES WILL BE ADDED AT 65% DESIGN.



RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
2. DATA TRANSFERRED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
   BY: _____

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		
PLAN CHECK		

GRAPHIC SCALE 40 20 0 20 40

FIELD BOOKS	BM NO.	LOCATION	ELEV.
DESIGN			
STAKING			
ASBUILT			
CONTRACTOR	BASIS OF THIS DATUM		
INSPECTOR			
CONSTRUCTION RECORD	VERTICAL DATUM		

REV	DATE	DESCRIPTION	BY
REVISIONS			

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
CONSULTANT

SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

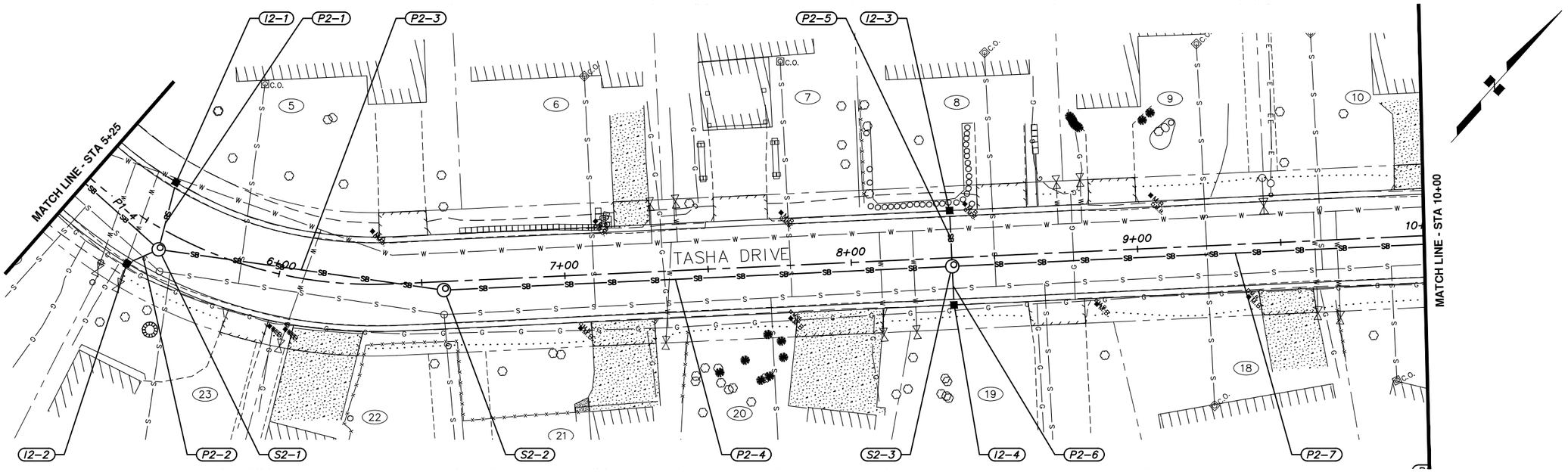
20-15 TASHA DRIVE RECONSTRUCTION SCHED B

STORM DRAIN PLAN & PROFILE

TASHA DRIVE
BOP TO STA 5+25

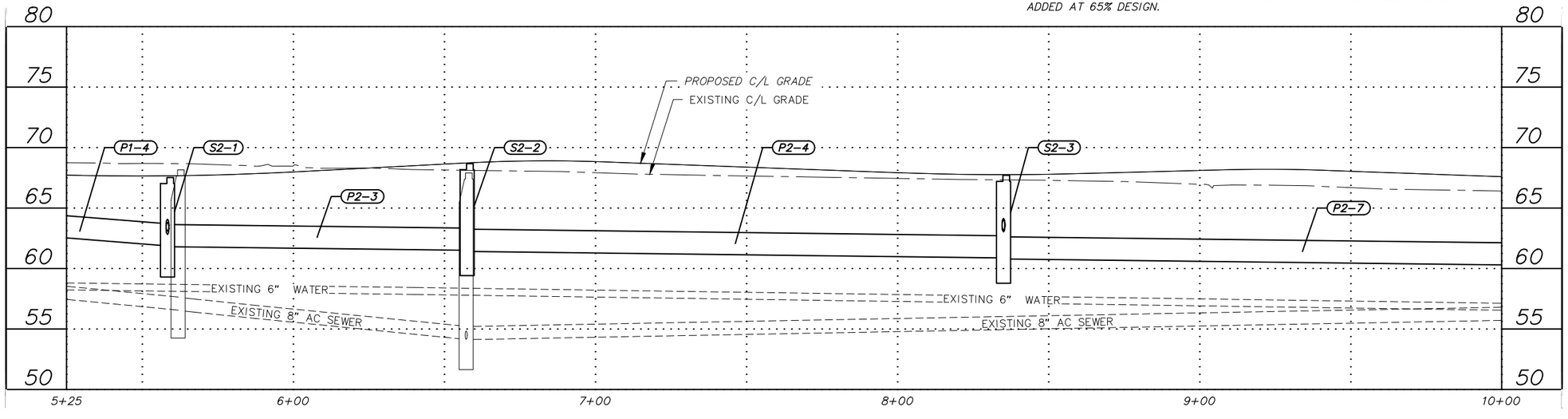
SCALE HOR. 1"=20'
VER. 1"=5'
GRID 2327
DATE OCT 2022
STATUS 35%
SHEET SD1 of SD5

File: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Storm Drain.dwg



NOTES:

1. REFER TO SHEET SD4 FOR GENERAL STORM DRAIN STRUCTURE/PIPE NOTES AND STRUCTURE ABBREVIATIONS USED ON SUMMARY TABLES SHOWN ON THIS SHEET.
2. REFER TO SHEETS SD4 FOR STORM DRAIN DETAILS.
3. REFER TO SHEETS SD5 FOR STORM DRAIN SUMMARY TABLES.
4. FOOTING DRAIN SERVICES NOT SHOWN. FOOTING DRAIN SERVICES WILL BE ADDED AT 65% DESIGN.



RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
2. DATA TRANSFERRED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
   BY: _____

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		
PLAN CHECK		

GRAPHIC 40 20 0 20 40 SCALE

FIELD BOOKS	BM NO.	LOCATION	ELEV.
DESIGN			
STAKING			
ASBUILT			
CONTRACTOR	BASIS OF THIS DATUM		
INSPECTOR			
CONSTRUCTION RECORD	VERTICAL DATUM		

REV	DATE	DESCRIPTION	BY
REVISIONS			

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
CONSULTANT

SEAL

UNIVERSITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

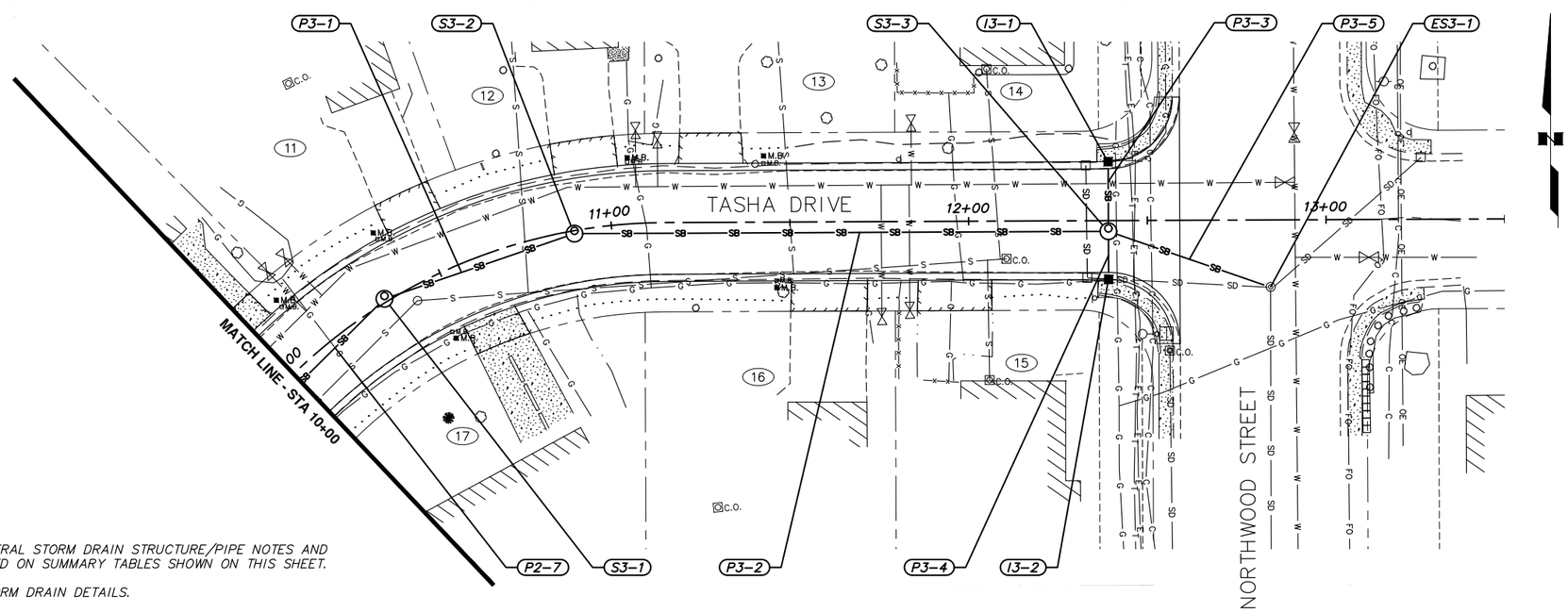
20-15 TASHA DRIVE RECONSTRUCTION SCHED B

STORM DRAIN PLAN & PROFILE

TASHA DRIVE
STA 5+25 TO 10+00

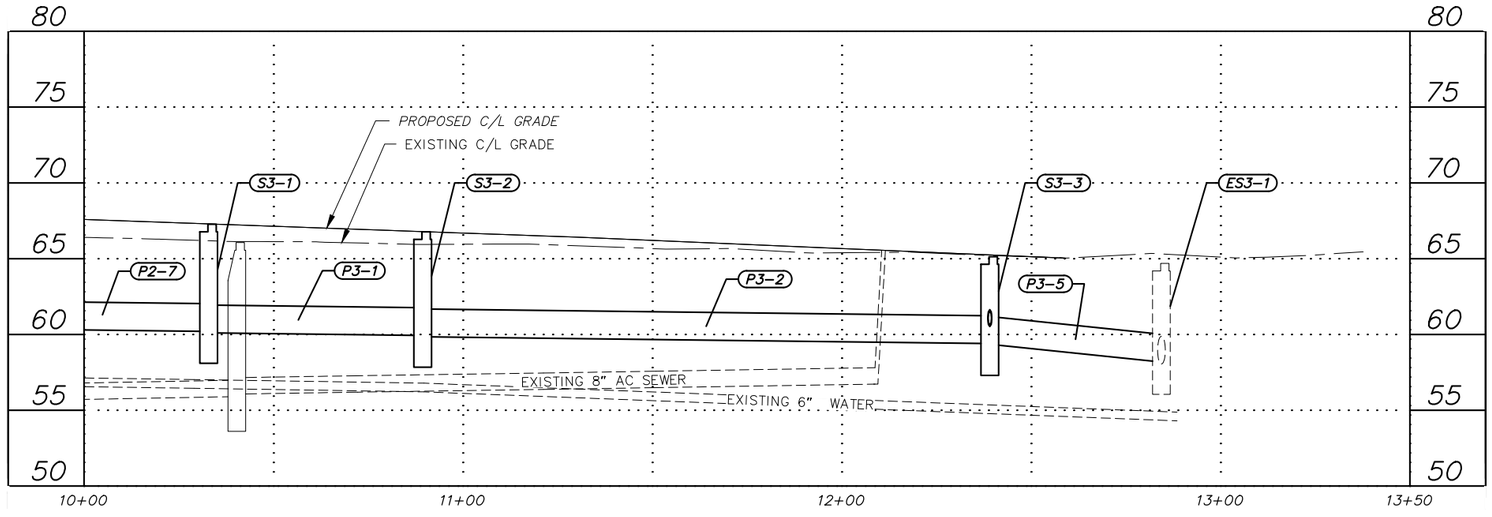
SCALE HOR. 1"=20' VER. 1"=5' | GRID 2327 | DATE OCT 2022 | STATUS 35% | SHEET SD2 of SD5

File J:\Jobs\Date\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Storm Drain.dwg



NOTES:

1. REFER TO SHEET SD4 FOR GENERAL STORM DRAIN STRUCTURE/PIPE NOTES AND STRUCTURE ABBREVIATIONS USED ON SUMMARY TABLES SHOWN ON THIS SHEET.
2. REFER TO SHEETS SD4 FOR STORM DRAIN DETAILS.
3. REFER TO SHEETS SD5 FOR STORM DRAIN SUMMARY TABLES.
4. FOOTING DRAIN SERVICES NOT SHOWN. FOOTING DRAIN SERVICES WILL BE ADDED AT 65% DESIGN.



RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
   THIS WILL SERVE TO CERTIFY THAT THESE RECORD DRAWINGS ARE A TRUE AND ACCURATE REPRESENTATION OF THE PROJECT AS CONSTRUCTED.
   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
2. DATA TRANSFERRED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
3. BASED ON PERIODIC FIELD OBSERVATIONS BY THE ENGINEER (OR AN INDIVIDUAL UNDER HIS/HER DIRECT SUPERVISION), THE CONTRACTOR-PROVIDED DATA APPEARS TO REPRESENT THE PROJECT AS CONSTRUCTED.
   DATA TRANSFER CHECKED BY: _____ TITLE: _____
   COMPANY: _____ DATE: _____
   BY: _____

DATA	DRAWN BY	CHECKED BY
BASE		
TOPOGRAPHY		
PROFILE		
STORM SEWER		
WATER/SANITARY SEWER		
GAS		
TELEPHONE		
ELECTRIC		
DESIGN		
QUANTITIES		
PRELIMINARY/FINAL		
MUNICIPAL/STATE		
PLAN CHECK		

GRAPHIC 40 20 0 20 40 SCALE

FIELD BOOKS	BM NO.	LOCATION	ELEV.
DESIGN			
STAKING			
ASBUILT			
CONTRACTOR	BASIS OF THIS DATUM		
INSPECTOR			
CONSTRUCTION RECORD	VERTICAL DATUM		

REV	DATE	DESCRIPTION	BY
REVISIONS			

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
CONSULTANT

SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

20-15 TASHA DRIVE RECONSTRUCTION SCHED B

STORM DRAIN PLAN & PROFILE

TASHA DRIVE
STA 10+00 TO EOP

SCALE HOR. 1"=20' VER. 1"=5'
GRID 2327
DATE OCT 2022
STATUS 35%
SHEET SD3 of SD5

File: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\01 Working Set\01 Civil\10150.00 Plan & Profile - Storm Drain.dwg

Storm Drain Condition Assessment Memo

Appendix D

Memorandum

Date:	October 24, 2020
To:	Jennifer Noffke & Russ Oswald, P.E. – MOA PM&E
From:	Joey Hegna, P.E. – CRW Engineering Group, LLC
Project:	Tasha Drive Reconstruction
Project No:	PM&E No. 20-15 (CRW No. 10150.00)
Subject:	Storm Drain Condition Assessment (DRAFT)

This memorandum summarizes the findings of the storm drain condition assessment performed by CRW Engineering Group, LLC (CRW) for the Tasha Drive Reconstruction project.

Project Background

The Municipality of Anchorage Project Management & Engineering Department (MOA PM&E) plans to upgrade approximately 1,200 feet of Tasha Drive from Flamingo Drive to Northwood Street to meet MOA design criteria for a local roadway. Proposed improvements are anticipated to include a new roadway structural section, drainage improvements, continuous street lighting, landscaping, and pedestrian facilities (if warranted). Refer to Appendix A for a project location & limits map.

The existing pavement conditions are very poor with cracking, settling, and heaving along Tasha Drive. Rolled curb and gutter is present along the entire project corridor, however, some sections of curb are broken and undulating significantly. Currently, there is no storm drain infrastructure along Tasha Drive except two catch basins located at the eastern project limits near Northwood Street. High groundwater and poor soils were identified during the geotechnical investigation, further increasing roadway degradation. Additionally, Tasha Drive experiences ponding in low lying areas that don't effectively drain, further exasperating the poor roadway conditions. These conditions are worsening over time, causing increased maintenance costs for MOA. These issues have also grown to be a large concern for residents along Tasha Drive.

Purpose

The purpose of this memorandum is to assess the condition of the existing storm drain infrastructure located along Northwood Street and W. 88th Avenue adjacent to Tasha Drive and Flamingo Drive. This project plans to extend a new storm/subdrain system along the project limits and connect to this existing infrastructure. The results of this assessment will serve a tool to determine if connecting to these existing systems is a viable option based on their condition.

Structure and Pipe Information

The structure and pipe identification numbers used throughout this memo and the appendices are based on the naming convention provided in MOA's online GIS Stormwater Asset Map and associated grid maps. The inspected structures and pipes are all located and identified on MOA storm drain grid map SW2327 included in Appendix A. In some cases, the structure IDs referenced were abbreviated (e.g. Structure 32327-174 = 174).

Refer to *Table 1*, Appendix D for the *Pipe & Structure Rating Scale*. This scale was used to assign a condition rating for the inspected storm drain pipe and structures in this memorandum.

Pipe Inspection – Procedure

The closed-circuit television (CCTV) data collection process works by operating a camera which is mounted on a self-propelled robotic crawler that is connected to a video monitor on the ground surface. The crawler is driven through the storm drain pipe to provide visual documentation of the condition of the interior walls of the pipe. The remotely controlled crawler and camera are typically inserted into the storm drain pipe from a manhole and are operated from the ground surface.

The purpose for collecting video images of the interior of the storm drain pipe is to identify obstructions, structural deficiencies, damaged areas, sags, and confirm the pipe size and material type.

MOA Street Maintenance inspected 6 pipe segments along Northwood Street and W. 88th Avenue on June 27, 2022 using a CCTV camera. Refer to Appendix A for the storm drain grid map identifying the pipes inspected.

CRW obtained the CCTV videos from MOA Street Maintenance to view and evaluate the condition of the storm drain pipe. A condition summary is provided below.

Pipe Inspection – Condition Summary

The CCTV data included video of approximately 1,170 linear feet (LF) of storm drain pipe. Five of six of the inspected pipe segments were main line pipe. The final pipe segment was a catch basin lead. The main line pipe located along Northwood Street includes 483 LF of 18-inch perforated corrugated polyethylene pipe (CPEP, Type SP). The catch basin lead at the intersection of Tasha Drive and Northwood Street is 49 LF of 10-inch CPEP, Type SP. The CPEP, Type SP pipe was installed in 1998 as part of the Northwood Drive/88th Avenue Surface Rehabilitation project (PM&E No. 96-13). The main line pipe located along W. 88th Avenue includes 642 LF of 24-inch perforated corrugated metal pipe (CMP). The installation date for the CMP pipe is unknown as record drawings were not obtained for this pipe. The CMP pipe is installed relatively deep (ranging from 8 to 13 feet of cover) compared to standard storm drain pipe (4 feet minimum cover).

The overall condition of the inspected storm drain pipe ranged from fair to good. Some of the issues identified included sediment/debris blockages, ovality/pipe deformation, joint offsets, separated pipe joints, bellies, corrosion, and mineralization. Refer to the Appendix C for the *Storm Drain Inspection Summary Table* and the individual *CCTV Inspection Forms* for a detailed assessment for each pipe segment that was inspected.

Below is a list of some of the notable pipe defects identified during review of the CCTV data:

Pipe 13467 (Northwood Street)

- 18-inch CPEP, Type SP (199 LF)
- Infiltration/mineralization at pipe joint
- Pipe ovality/deformation
- Good condition

Pipe 25631 (Northwood Street)

- 18-inch CPEP, Type SP (284 LF)
- Offset joints
- Pipe ovality/deformation

Photo 1 - Pipe 25631 (Ovality)

- Infiltration/mineralization and belly/low point at pipe joints
- Good condition

Pipe 28173 (Tasha Drive/Northwood Street)

- 10-inch CPEP, Type SP (49 LF)
- Separated pipe joints
- Belly/low point at end of pipe
- Good condition

Pipe 28650 (W. 88th Avenue)

- 24-inch perforated CMP (130 LF)
- Infiltration/mineralization at pipe joints
- Separated pipe joint
- Fair condition

Photo 2 - Pipe 28650 (Mineral Deposit at Pipe Joint)

Pipe 28569 (W. 88th Avenue)

- 24-inch perforated CMP (204 LF)
- Debris/blockages in pipe
- Infiltration/mineralization at pipe perforations
- Fair condition

Pipe 29690 (W. 88th Avenue)

- 24-inch perforated CMP (308 LF)
- Separated pipe joints
- Belly/low point at pipe joint
- Good condition

As noted above, all inspected pipe was determined to be in good or fair condition. Based on this assessment, connecting to any pipe segment for the proposed storm drain upgrades is a viable option for this project.

Structure Inspection – Procedure

An inspection was performed on three storm drain structures located on Northwood Street (32327-174) and W. 88th Avenue (32327-037 & 118) on October 6, 2022. The inspection was conducted by removing the manhole cover to view the interior of the structure. Each structure was assessed from the ground surface; no structures were entered for this effort. Any notable characteristics, irregularities, and/or defects were documented and photographed and are presented on the *Storm Drain Structure Inspection Forms,* Appendix B. The condition of the components of each structure (e.g. cover, grade rings, cone, barrel, ladder rungs, etc.) were scored between 1 and 4 (poor to good, respectively).

Structure Inspection – Condition Summary

The three manholes inspected are all Type I storm drain manholes (4-foot inside diameter) with eccentric cones. All three manholes are located in the roadway with solid manhole covers (no top intakes). Two of the structures (32327-118 & 174) were installed in 1998 as part of the Northwood Drive/88th Avenue Surface Rehabilitation project (PM&E No. 96-13). The installation date for the remaining manhole (32327-037) is unknown as record drawings were not obtained for this manhole. The two structures on W. 88th Avenue (32327-037 & 118) are installed relatively deep (~17 feet from rim

to base) compared to a standard storm drain installation (~8 feet) like the one on Northwood Street (32327-174).

The overall condition of the inspected storm drain manholes ranged from fair to good. Some of the issues identified included damaged grade rings, non-standard ladder rungs and covers, and cracking/spalling at pipe penetrations.

Below is a list of some of the defects or irregularities observed in the inspected structures:

<u>Manhole 32327-037 (W. 88th Avenue)</u>

- Non-standard rungs and cover
- Deep structure
- Good condition

<u>Manhole 32327-118 (W. 88th Avenue)</u>

- Vertical cracking and concrete loss from grade rings
- Deep structure
- Good condition

<u>Manhole 32327-174 (Northwood Street)</u>

- Spalling and concrete loss from grade rings
- Metal shims/spacers inserted into grade ring gaps
- Minor cracking/spalling at pipe penetrations
- Fair condition

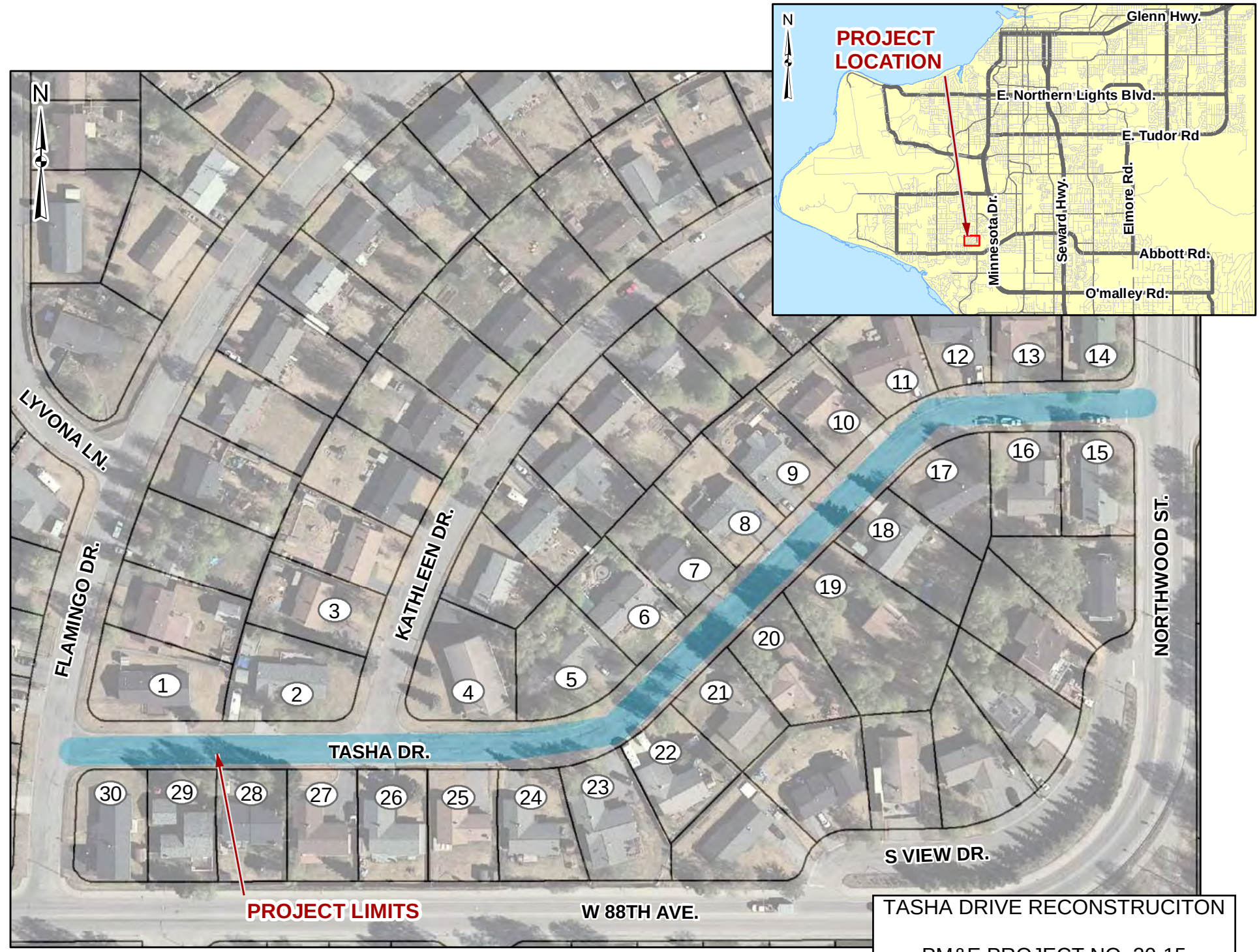
Photo 3 - Interior of Manhole 32327-037

The two structures on W. 88th Avenue are in good condition and connecting to these manholes with new storm drain pipe is a viable option. The structure on Northwood Street is in fair condition and additional consideration is warranted if the proposed storm drain pipe ties into this manhole. The existing catch basin (32327-123), catch basin manhole (32327-122), and connecting pipes (13696 & 28173) on Tasha Drive west of Northwood Street will likely be removed and replaced due to realigned curb and gutter associated with the proposed roadway improvements. If this is the case, reusing the pipe penetration from Pipe 28173 into Manhole 32327-174 would minimize impacts to the existing structure, making it more workable option. This will be reviewed and considered in more depth during the design phase.

-End of Memorandum-

Appendix A

Project Figures



TASHA DRIVE RECONSTRUCITON

PM&E PROJECT NO. 20-15

PROJECT LOCATION & LIMITS MAP

Legend

- Confined Space
- Manhole
- Catchbasin Manhole
- Clean-Out
- Catch Basin
- OGS
- Lift Station
- Diverter
- Drywell
- Weir
- Blind Connect
- Top Intake Manhole
- Roof Drain
- Bypass Outlet
- Curb Inlet
- End of Pipe
- Pipe Inlet
- Pipe Cap
- Inlet
- Pipe Outlet
- Control Inlet
- Control Outlet
- Other
- Outfall
- Outfall Major
- Outfall Minor
- Sink -(Closed Drainage Basin)
- Divide
- Feature Start
- Other

Storm Pipes

- ADOT
- ADOT-Airport
- Abandoned
- Fed_Military
- MOA-ASD
- MOA-Facility Maintenance
- MOA-Merrill Field
- MOA-Other
- MOA-Parks and Recreation
- MOA-Port of Anchorage
- MOA-M&O/CBERRRSA/LRSA/SA
- Private
- SOA-Alaska Railroad
- Unknown

Thaw Wire

- MOA-ASD
- MOA-Facility Maintenance
- MOA-M&O/CBERRRSA/LRSA/SA
- MOA-Parks and Recreation
- Private
- Bridge

Constructed Channels

- ADOT
- MOA-M&O/CBERRRSA/LRSA/SA
- MOA-Other
- Port of Alaska; MOA-Port of Alaska
- MOA-M&O/CBERRRSA/LRSA/SA
- Private
- SOA-Alaska Railroad
- Unknown

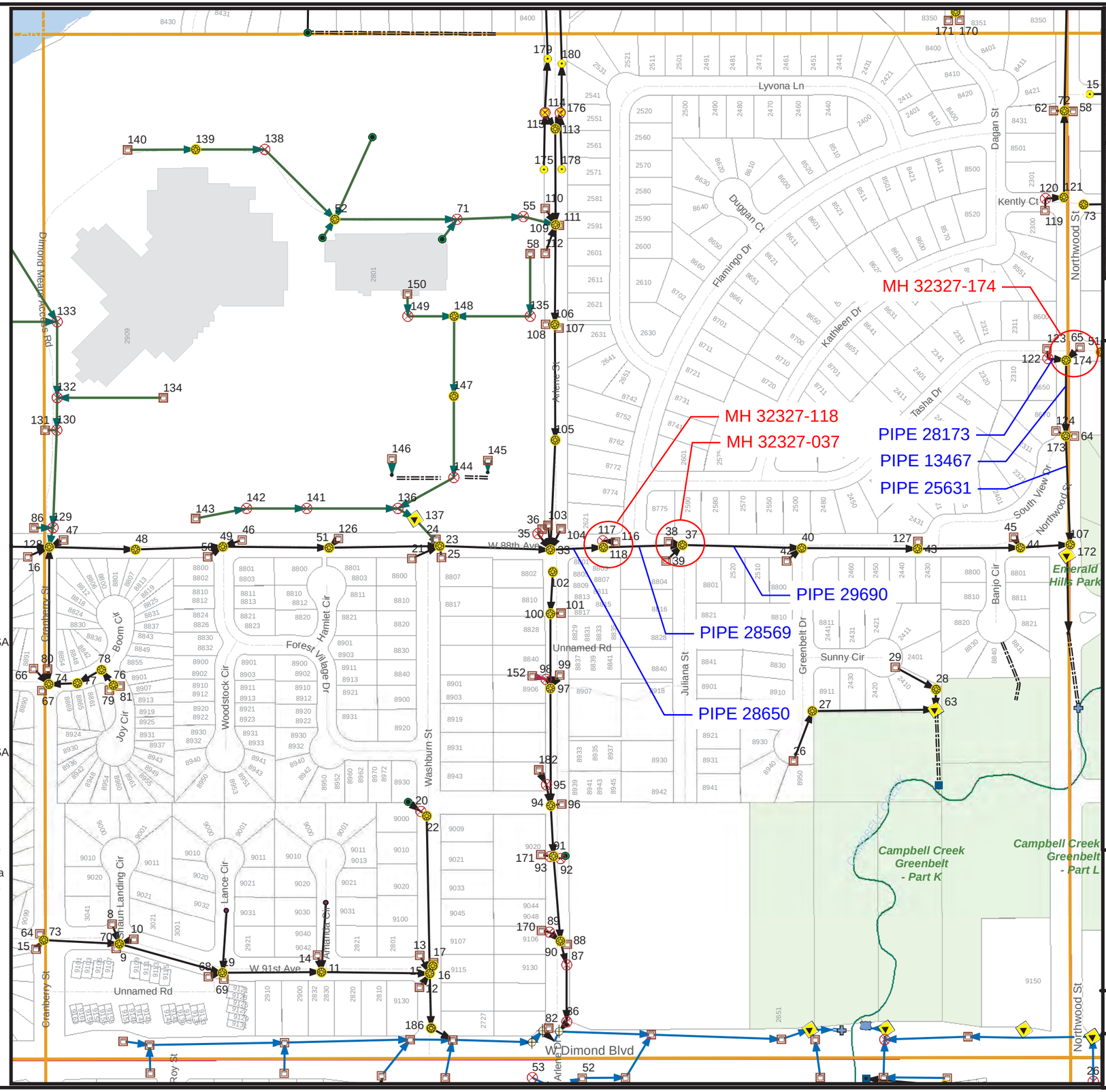
Other Drainageways

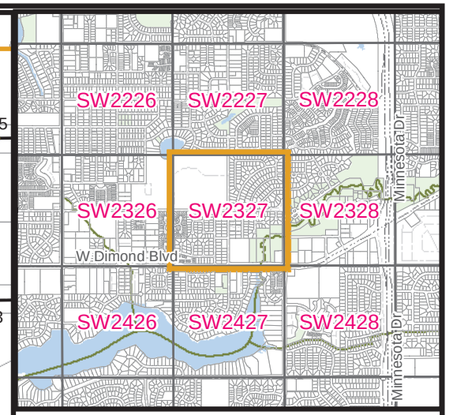
- Other Drainageways

N W E S

0 150 300 600

Feet





Anchorage Bowl
Legal: SE 1/4 Sec11 T12N R4W

Notes:

MOA Storm Drain and Drainage Atlas

Map Created: 5/23/2020

Grid Number

SW2327

Appendix B

Storm Drain Structure Inspection Forms

CRW ENGINEERING GROUP, LLC

STORM DRAIN STRUCTURE INSPECTION FORM

TASHA DRIVE RECONSTRUCTION (PM&E No. 20-15)

INSPECTION DATE:	10/6/2022	INSPECTION TIME:	9:30 a.m.
WEATHER:	Sunny - 50°	INSPECTED BY:	Joey Hegna, P.E.
STRUCTURE ID NUMBER:	32327-037	STRUCTURE TYPE:	Manhole

APPROXIMATE LOCATION: Manhole locate on 88th Avenue north of Juliana Street. MH Cover located north of centerline in asphalt.

CONDITION	POOR	←		→	GOOD
CONDITION OF FRAME & COVER/INLET	1	(2)	3		4
CONDITION OF GRADE RINGS	1	2	(3)		4
CONDITION OF CONE/REDUCING SLAB	1	2	(3)		4
CONDITION OF BARREL	1	2	(3)		4
CONDITION OF LADDER	1	2	(3)		4
CONDITION OF INLET & OUTLET PIPES	1	2	(3)		4
CONDITION OF SUMP	1	2	3		4
PRESENCE OF DEBRIS/SOLIDS		YES		(NO)	
PRESENCE OF INFILTRATION/INFLOW		YES		(NO)	

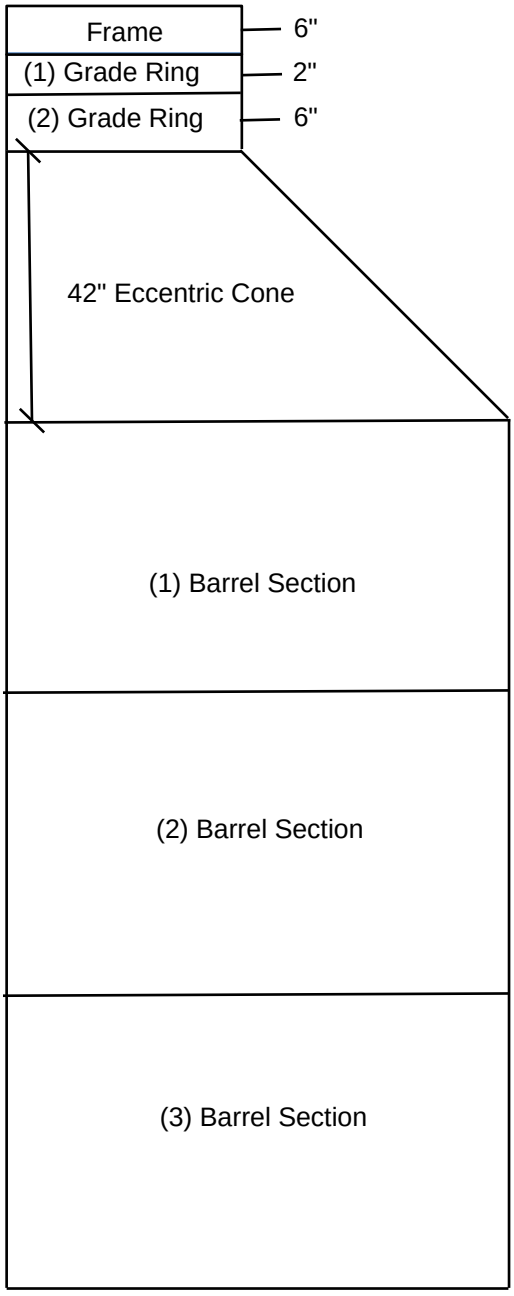
DEPTH/VOLUME OF FLOW: 2 – 3” of flow through mainline pipe during inspection

DIAMETER OF STRUCTURE: 4’ (Type I)

STRUCTURE ASSESSMENT/CONDITION NOTES:

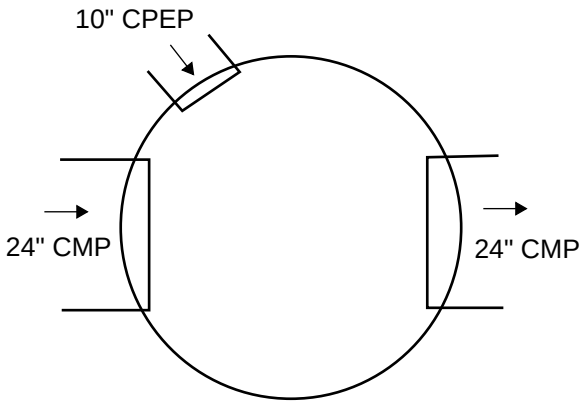
- Eccentric Cone
- Metal loss present on frame and cover
- (10) Non-standard metal ladder rungs – missing 2 rungs near MH base due to pipe conflict
- No flow from leads at time of inspection
- Sump full of water/runoff – unable to inspect
- (2) Grade rings – both in good condition (no cracking or spalling)
- Non-standard cover
- Structure in overall good condition

MANHOLE SKETCH

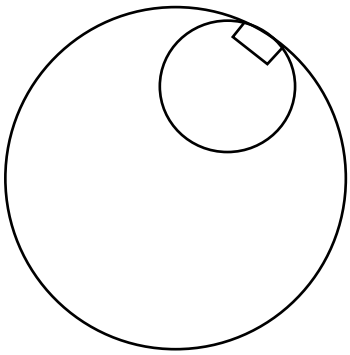


PROFILE

NORTH



INLET & OUTLET PIPE CONFIGURATION



COVER/INLET CONFIGURATION

PLAN

Structure 32327-037

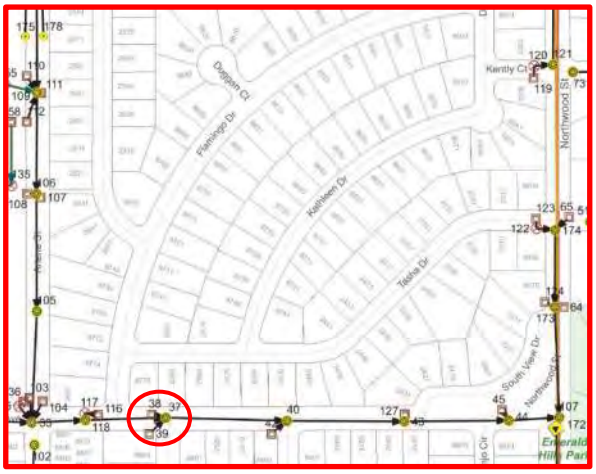


Photo 1 - Structure Location

Photo 2 - Surface View

Photo 3 - Manhole Cover

Photo 4 - Interior of Manhole

Photo 5 - Manhole Frame

CRW ENGINEERING GROUP, LLC

STORM DRAIN STRUCTURE INSPECTION FORM
TASHA DRIVE RECONSTRUCTION (PM&E No. 20-15)

INSPECTION DATE:	10/6/2022	INSPECTION TIME:	9:10 a.m.
WEATHER:	Sunny - 50°	INSPECTED BY:	Joey Hegna, P.E.
STRUCTURE ID NUMBER:	32327-118	STRUCTURE TYPE:	Manhole

APPROXIMATE LOCATION: Manhole located on 88th Avenue west of Flamingo Drive. MH Cover located north of centerline in asphalt.

CONDITION	POOR	←		→	GOOD
CONDITION OF FRAME & COVER/INLET	1	2	(3)		4
CONDITION OF GRADE RINGS	1	(2)	3		4
CONDITION OF CONE/REDUCING SLAB	1	2	(3)		4
CONDITION OF BARREL	1	2	(3)		4
CONDITION OF LADDER	1	2	(3)		4
CONDITION OF INLET & OUTLET PIPES	1	2	(3)		4
CONDITION OF SUMP	1	2	3		4
PRESENCE OF DEBRIS/SOLIDS		YES		(NO)	
PRESENCE OF INFILTRATION/INFLOW		YES		(NO)	

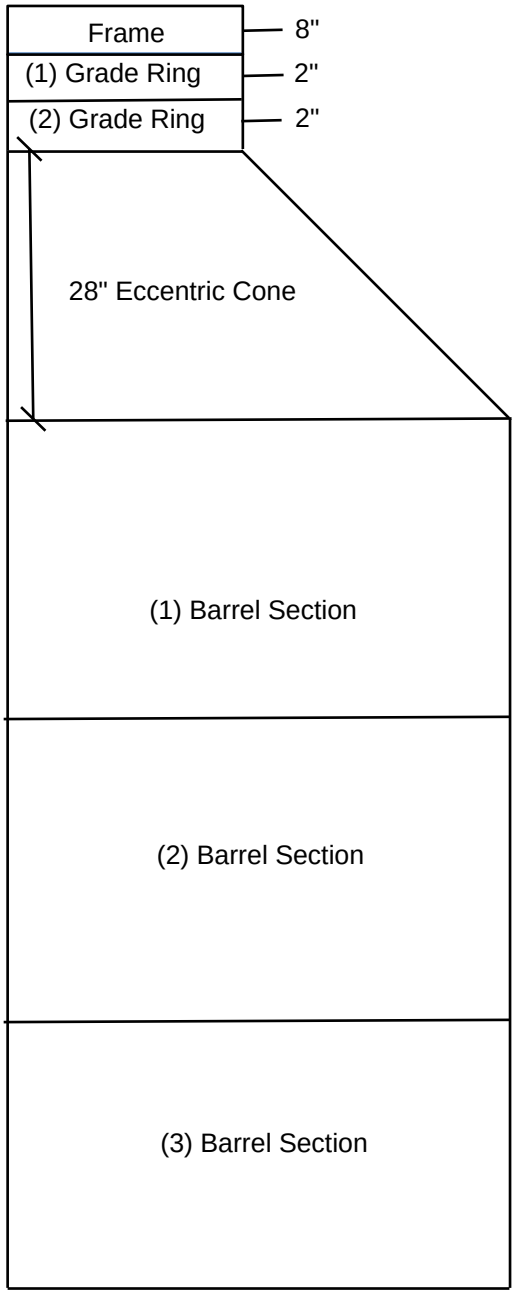
DEPTH/VOLUME OF FLOW: 2 – 3” of flow through mainline pipe during inspection

DIAMETER OF STRUCTURE: 4’ (Type I)

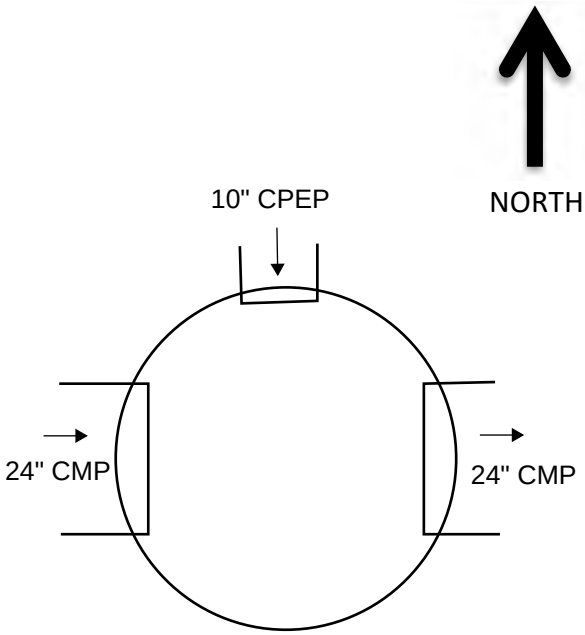
STRUCTURE ASSESSMENT/CONDITION NOTES:

- Eccentric cone
- Metal loss present on frame and cover
- Vertical cracking, spalling and concrete loss from grade rings
- (14) Non-standard metal ladder rungs
- No flow from lead at time of inspection
- Sump full of water/runoff – unable to inspect
- (2) Grade rings – both in poor condition (cracks, concrete loss)
- Non-standard cover
- Structure in overall good condition

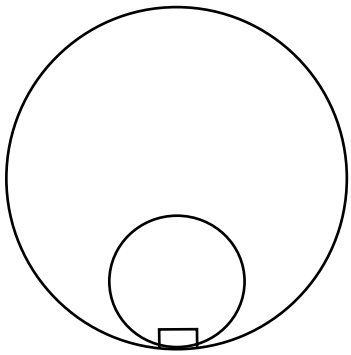
MANHOLE SKETCH



PROFILE



INLET & OUTLET PIPE CONFIGURATION



COVER/INLET CONFIGURATION

PLAN

Structure 32327-118

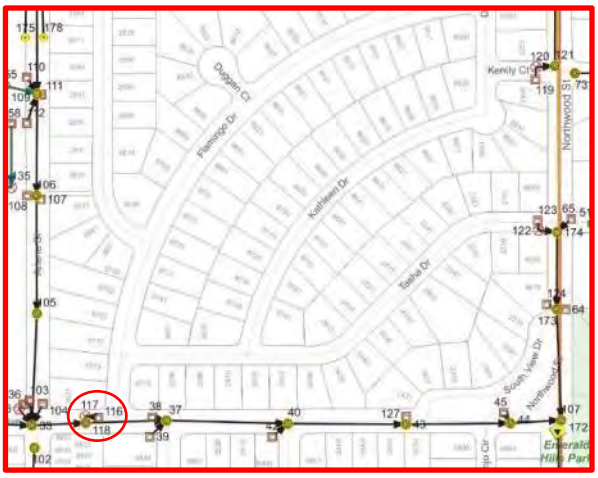


Photo 2 - Structure Location

Photo 1 - Surface View

Photo 3 - Manhole Cover

Photo 4 - Interior of Manhole

Photo 5 - Grade Ring Damage

CRW ENGINEERING GROUP, LLC

STORM DRAIN STRUCTURE INSPECTION FORM

TASHA DRIVE RECONSTRUCTION (PM&E No. 20-15)

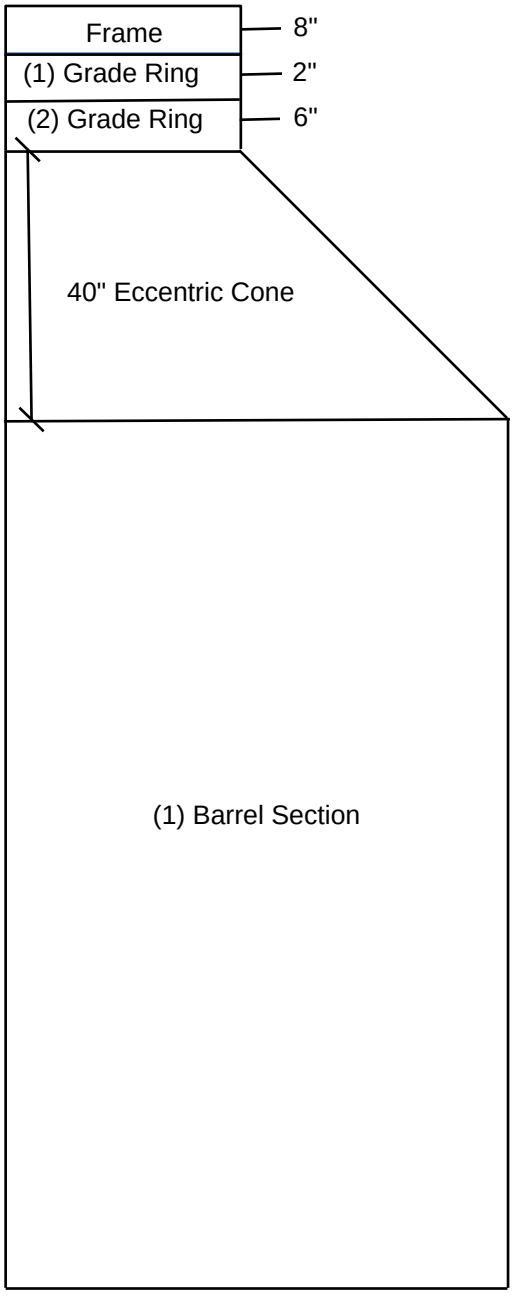
INSPECTION DATE:	10/6/2022	INSPECTION TIME:	10:10 a.m.
WEATHER:	Sunny - 50°	INSPECTED BY:	Joey Hegna, P.E.
STRUCTURE ID NUMBER:	32327-174	STRUCTURE TYPE:	Manhole
APPROXIMATE LOCATION:	Manhole located at intersection of Northwood Street & Tasha Drive. MH cover located in center turn lane.		

CONDITION	POOR	←		→	GOOD
CONDITION OF FRAME & COVER/INLET	1	2	(3)		4
CONDITION OF GRADE RINGS	(1)	2	3		4
CONDITION OF CONE/REDUCING SLAB	1	2	(3)		4
CONDITION OF BARREL	1	(2)	3		4
CONDITION OF LADDER	1	2	(3)		4
CONDITION OF INLET & OUTLET PIPES	1	(2)	3		4
CONDITION OF SUMP	1	2	3		4
PRESENCE OF DEBRIS/SOLIDS		YES		(NO)	
PRESENCE OF INFILTRATION/INFLOW		(YES)		NO	
DEPTH/VOLUME OF FLOW:	Trickle flow from catch basin lead.				
DIAMETER OF STRUCTURE:	4' (Type I)				

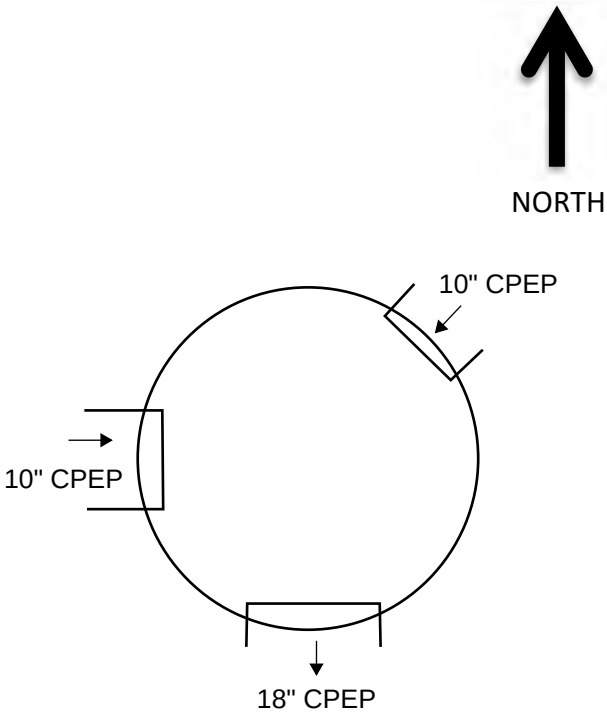
STRUCTURE ASSESSMENT/CONDITION NOTES:

- Eccentric cone
- Metal loss present on frame
- (5) Non-standard metal ladder rungs
- Non-standard cover
- Sump full of water/runoff – unable to inspect
- Spalling and concrete loss from grade rings
- Metal shims/spacers added to account for concrete loss in grade rings
- Minor cracking/spalling at pipe penetrations
- Structure in fair condition

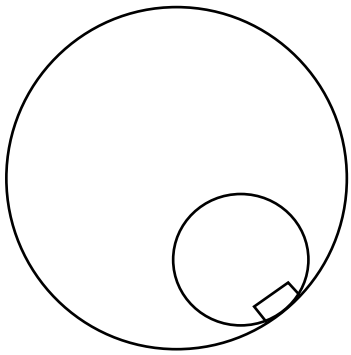
MANHOLE SKETCH



PROFILE



INLET & OUTLET PIPE CONFIGURATION



COVER/INLET CONFIGURATION

PLAN

Structure 32327-174

Photo 1 - Structure Location

Photo 2 - Surface View

Photo 3 - Manhole Cover

Photo 4 - Interior of Manhole

Photo 5 - Metal Shims/Spacers in Grade Ring

Photo 6 - Infiltration at Base/Cone Joint

Appendix C

Storm Drain Pipe Summary & Inspection Forms

Tasha Drive Reconstruction (PM&E No. 20-15)
Storm Drain Pipe Inspection Summary Table

MOA Pipe Identification No.	Upstream Structure No.	Downstream Structure No.	Diameter (in)	Material	Install Year	Inspection Date	Inspection Direction	Length (ft)	Condition	Pipe Condition Observations & Comments
Northwood Street										
13467	32327-174	32327-173	18	CPEP, SP	1998	6/27/2022	Upstream	199	Good	Minor debris at pipe invert (140' upstream from 32327-173). Infiltration/mineralization at pipe joint (20' upstream from 32327-173). Pipe ovality (60' upstream from 32327-173). Pipe ovality (140' upstream from 32327-173). Pipe ovality (160' upstream from 32327-173).
25631	32327-173	32328-107	18	CPEP, SP	1998	6/27/2022	Downstream	284	Good	Mineralization/deposits at numerous locations throughout pipe segment. Pipe ovality (52' & 112' downstream from 32327-173). Offset joints (75', 95' & 195' downstream from 32327-173). Infiltration/mineralization and belly at pipe joints (215', 235' & 274' downstream from 32327-173). Infiltration/mineralization at pipe joint (254' downstream from 32327-173).
28173	32327-122	32327-174	10	CPEP, SP	1998	6/27/2022	Downstream	49	Good	Sediment/debris at numerous locations throughout pipe segment. Separated pipe joints (20' & 40' downstream from 32327-122). Belly/low point (44' downstream from 32327-122).
W. 88th Avenue										
28650	32327-033	32327-118	24	CMP	Unknown	6/27/2022	Upstream	130	Fair	Debris at 7 o'clock (8' upstream from 32327-118). Mineral deposit at pipe joints (60' & 100' upstream from 32327-118). Separated pipe joint (122' upstream from 32327-118). Historic high water mark near springline of pipe. Corrosion/mineralization present below springline at perforations and at pipe joints throughout pipe segment.
28569	32327-118	32327-037	24	CMP	Unknown	6/27/2022	Upstream	204	Fair	Debris at 9 o'clock (26' upstream from 32327-037). Debris at 5 o'clock (84' upstream from 32327-037). Debris at 4 o'clock (166' upstream from 32327-037). Significant infiltration/mineralization through perforations below springline (124' upstream from 32327-037). Corrosion and infiltration/mineralization at pipe joints (142', 154', 166', 180' & 191' upstream from 32327-037). Historic high water mark near springline of pipe.
29690	32327-037	32327-040	24	CMP	Unknown	6/27/2022	Downstream	308	Good	Separated pipe joints (186' & 235' downstream from 32327-037). Belly at pipe joint (278' downstream from 32327-037). Historic high water mark near springline of pipe.

Tasha Drive Reconstruction (PM&E No. 20-15)
MOA Pipe #13467 - Northwood Street

General Inspection Data:

Inspection Date: 6/27/2022
Inspection Completed by: MOA Street Maintenance (Ryan A. Frise)
Inspection Direction: Upstream

Pipe Data:

Diameter/Material: 18" CPEP, Type SP (Perforated)
Length (approx.): 199'
Main or Lead: Main
Install Year: 1998
Condition: Good
Upstream Structure No.: 32327-174
Downstream Structure No.: 32327-173
Flow Depth: No flow during inspection
Debris/Obstructions: Minor debris at pipe invert (140' upstream from 32327-173).
Miscellaneous/Defect Notes: Infiltration/mineralization at pipe joint (20' upstream from 32327-173). Pipe ovality (60', 140' & 160' upstream from 32327-173). Historic high water mark below springline of pipe.

Inspection Images:

Photo 1: Infiltration/mineralization

Photo 2: Debris and pipe ovality

Tasha Drive Reconstruction (PM&E No. 20-15)
MOA Pipe #25631 - Northwood Street

General Inspection Data:

Inspection Date: 6/27/2022
Inspection Completed by: MOA Street Maintenance (Ryan A. Frise)
Inspection Direction: Downstream

Pipe Data:

Diameter/Material: 18" CPEP, Type SP (Perforated)
Length (approx.): 284'
Main or Lead: Main
Install Year: 1998
Condition: Good
Upstream Structure No.: 32327-173
Downstream Structure No.: 32328-107
Flow Depth: No flow during inspection
Debris/Obstructions: Mineralization/deposits at numerous locations throughout pipe segment.
Miscellaneous/Defect Notes: Pipe ovality (52' & 112' downstream from 32327-173). Offset joints (75', 95' & 195' downstream from 32327-173). Infiltration/mineralization and belly at pipe joints (215', 235' & 274' downstream from 32327-173). Infiltration/mineralization at pipe joint (254' downstream from 32327-173). Historic high water mark below springline of pipe.

Inspection Images:

Photo 1: Pipe ovality

Photo 2: Infiltration/mineralization and belly at pipe joint

Tasha Drive Reconstruction (PM&E No. 20-15)
MOA Pipe #28173 - Tasha Drive/Northwood Street

General Inspection Data:

Inspection Date: 6/27/2022
Inspection Completed by: MOA Street Maintenance (Ryan A. Frise)
Inspection Direction: Downstream

Pipe Data:

Diameter/Material: 10" CPEP, Type SP (Perforated)
Length (approx.): 49'
Main or Lead: Lead
Install Year: 1998
Condition: Good
Upstream Structure No.: 32327-122
Downstream Structure No.: 32327-174
Flow Depth: No flow during inspection
Debris/Obstructions: Sediment/debris at numerous locations throughout pipe segment.
Miscellaneous/Defect Notes: Separated pipe joints (20' & 40' downstream from 32327-122). Belly/low point (44' downstream from 32327-122). Historic high water mark near springline of pipe.

Inspection Images:

Photo 1: Separated joint & debris

Photo 2: Belly/low point in pipe

Tasha Drive Reconstruction (PM&E No. 20-15)
MOA Pipe #28650 - W. 88th Avenue

General Inspection Data:

Inspection Date: 6/27/2022
Inspection Completed by: MOA Street Maintenance (Ryan A. Frise)
Inspection Direction: Upstream

Pipe Data:

Diameter/Material: 24" CMP (Perforated)
Length (approx.): 130'
Main or Lead: Main
Install Year: Unknown
Condition: Fair
Upstream Structure No.: 32327-033
Downstream Structure No.: 32327-118
Flow Depth: <10% of full flow
Debris/Obstructions: Debris at 7 o'clock (8' upstream from 32327-118).

Miscellaneous/Defect Notes: Mineral deposit at pipe joints (60' & 100' upstream from 32327-118). Separated pipe joint (122' upstream from 32327-118). Historic high water mark near springline of pipe. Corrosion/mineralization present below springline at perforations and at pipe joints throughout pipe segment.

Inspection Images:

Photo 1: Mineral deposits

Photo 2: Separated pipe joint

Tasha Drive Reconstruction (PM&E No. 20-15)
MOA Pipe #28569 - W. 88th Avenue

General Inspection Data:

Inspection Date: 6/27/2022
Inspection Completed by: MOA Street Maintenance (Ryan A. Frise)
Inspection Direction: Upstream

Pipe Data:

Diameter/Material: 24" CMP (Perforated)
Length (approx.): 204'
Main or Lead: Main
Install Year: Unknown
Condition: Fair
Upstream Structure No.: 32327-118
Downstream Structure No.: 32327-037
Flow Depth: <10% of full flow
Debris/Obstructions: Debris at 9 o'clock (26' upstream from 32327-037). Debris at 5 o'clock (84' upstream from 32327-037). Debris at 4 o'clock (166' upstream from 32327-037).
Miscellaneous/Defect Notes: Significant infiltration/mineralization through perforations below springline (124' upstream from 32327-037). Corrosion and infiltration/mineralization at pipe joints (142', 154', 166', 180' & 191' upstream from 32327-037). Historic high water mark near springline of pipe.

Inspection Images:

Photo 1: Infiltration/mineralization through perforations

Photo 2: Debris in pipe

Tasha Drive Reconstruction (PM&E No. 20-15)
MOA Pipe #29690 - W. 88th Avenue

General Inspection Data:

Inspection Date: 6/27/2022
Inspection Completed by: MOA Street Maintenance (Ryan A. Frise)
Inspection Direction: Downstream

Pipe Data:

Diameter/Material: 24" CMP (Perforated)
Length (approx.): 308'
Main or Lead: Main
Install Year: Unknown
Condition: Good
Upstream Structure No.: 32327-037
Downstream Structure No.: 32327-040
Flow Depth: <10% of full flow
Debris/Obstructions: None present

Miscellaneous/Defect Notes: Separated pipe joints (186' & 235' downstream from 32327-037). Belly at pipe joint (278' downstream from 32327-037). Historic high water mark near springline of pipe.

Inspection Images:

Photo 1: Separated pipe joint

Photo 2: Belly in pipe

Appendix D

Pipe & Structure Rating Scale

Tasha Drive Reconstruction (PM&E No. 20-15)

RATING SCALE AND ASSOCIATED ACTION					
	1	2	3	4	5
	GOOD	FAIR	POOR	CRITICAL	FAILED
CONDITION	Like new, with little or no deterioration, structurally sound and functionally adequate.	Some deterioration, but structurally sound and functionally adequate.	Significant deterioration and/or functional inadequacy, requiring maintenance or repair.	Very poor conditions that indicate possible imminent failure which could threaten public safety.	Failed or non-functional condition.
ACTION INDICATED	No action is recommended. Note in inspection report only.	No immediate action is recommended, but more frequent inspection may be warranted. Maintenance personnel should be informed.	Team Leader (Inspector) evaluates need for corrective action and makes recommendation in inspection report.	Corrective action is required and urgent. Engineering evaluation is required to specify appropriate repair.	Emergency action is required to address public safety hazard. Roadway closure is typical.

Table 1: Pipe & Structure Rating Scale & Associated Action

Geotechnical Report

Appendix E

Geotechnical Investigation

Tasha Drive Reconstruction

(MOA PM&E Project No. 20-15)

October 2022

Contact
Steven Halcomb, PE, GE, DGE
shalcomb@crweng.com

3940 Arctic Blvd., Suite 300 Anchorage, AK 99503
p (907) 562.3252 | f (907) 561.2273

Geotechnical Investigation
Tasha Drive Reconstruction
(MOA PM&E Project No. 20-15)

Submitted To:

Jennifer Noffke
Project Administrator
Municipality of Anchorage
Project Management & Engineering Department
4700 Elmore Road
Anchorage, AK 99507

Submitted By:

CRW Engineering Group, LLC
3940 Arctic Blvd., Suite 300
Anchorage, AK 99503
(907) 562-3252
www.crweng.com

10.26.2022

Steven Halcomb, PE, GE, D.GE
Senior Geotechnical Engineer

Ali Sacks, PE
Geotechnical Engineer

October 2022
CRW Project Number 10150.00

Table of Contents

Tables

Figures

Appendices

1. Introduction and Project Description

CRW Engineering Group, LLC (CRW) is pleased to present this geotechnical investigation and design recommendations report to support the upgrades to Tasha Drive from Flamingo Drive to Northwood Street in Anchorage, Alaska. A project vicinity map is shown in Figure 1.

The project is being managed by the Municipality of Anchorage (MOA) Project Management and Engineering Department (PM&E) and has been assigned MOA PM&E project number 20-15. Improvements are expected to include a new roadway structural section, pavement, drainage improvements, streetlights, landscaping, and possibly a pedestrian facility. CRW is the design engineer of record therefore CRW geotechnical engineers will work closely with the CRW civil and roadway designers to coordinate on design elements if not addressed in this report.

The scope of work included:

- Reviewing historical geotechnical investigations within and near the project area.
- Performing a geotechnical field investigation including advancing five boreholes along the project alignment and soil sampling.
- Installing three piezometer wells for groundwater level monitoring.
- Overseeing index laboratory testing of recovered soil samples including moisture content, grain size distribution, hydrometer, and Atterberg Limits.
- Analyzing field observations and testing results.
- Preparing the geotechnical report to provide recommendations for the project.

2. Existing Conditions

Tasha Drive is a local road situated north of 88th Avenue and west of Northwood Street (Figure 1). The street is a two-lane, paved roadway with curb and gutter and no sidewalks. The street pavement shows significant distress along the project corridor including cracking, settling, heaving, and broken curb and gutter.

Storm and meltwater are currently conveyed through surface runoff to existing catch basins located at the ends of the project corridor. No piped drainage infrastructure is located along the majority of the project. The roadway has a moderate grade with some adjacent steep driveways.

3. Subsurface Investigation

CRW's geotechnical investigation consisted of drilling and sampling 5 boreholes (BH-01 through BH-05) on June 2nd, 2021, at the locations shown in Figure 2. Borehole locations were selected by CRW following the guidelines presented in the 2007 MOA PM&E Design Criteria Manual (DCM) Section 1.7 – Soil Investigation Standards. The soil boring locations were approved by PM&E prior to performing the field investigations.

Initial boring locations were submitted to local utilities for gaining acceptable clearance from their facilities and were adjusted for traffic control safety and utility proximity prior to drilling. Select site investigation photographs can be found in Appendix C.

3.1 Subsurface Drilling

Drilling services were provided by Discovery Drilling Inc. (Discovery) of Anchorage, Alaska, using a truck-mounted CME-75 drill rig equipped with a nominal 8-inch outer diameter (O.D.) hollow-stem auger. When drilling through the asphalt pavement, an approximately 12-inch diameter hole was cut in the pavement with a saw tooth bit prior to advancing the borehole.

Traffic control was performed in accordance with the requirements of the MOA approved traffic control plan.

A CRW engineer supervised the field exploration program, recovered soil samples, and managed field operations. All borings were advanced to a depth of 17 feet below ground surface (BGS).

3.2 Sample Collection

Soil samples were obtained by advancing an oversized split-spoon sampler into the soil beyond the bottom of the auger or by collecting cuttings from the auger. Samples were collected using a 3-inch outer diameter (O.D.) split-spoon sampler as a modified Standard Penetration Test (SPT). The sampler was advanced 24 inches, counted in 6-inch intervals, using a 340-pound automatic hammer. The number of blows required to drive the sampler each 6-inch interval is reported on the borehole logs. The blow counts shown on the borehole logs are field values that have not been corrected for overburden, sampler size, hammer energy, rod length, or other factors.

Split-spoon samples were collected at approximately 2.5-foot intervals in the top 10 feet and every 5 feet thereafter. Recovered samples were visually classified in the field before being individually sealed in double plastic bags and transported to the soils laboratory for additional testing. Field visual classifications were verified through laboratory testing. Soil characteristics, such as classification, consistency, moisture, and color were noted for each sample recovered. Classification was performed following the Unified Soil Classification System (USCS) according to ASTM D2487/D2488. Frost classifications of the soil were described according to the MOA DCM standards.

3.3 Borehole Completion and Piezometer Well Installation

All boreholes were backfilled with cuttings brought to the ground surface during drilling. In select borings (BH-01, BH-03, and BH-05), a 1-inch PVC piezometer well was installed for groundwater level monitoring. The PVC pipe was hand-slotted the last 10 feet and was installed over the length of each boring. After the piezometer was installed, the annular space around the PVC was backfilled with cuttings. A 7-inch flush mount cover was installed at the surface with the annulus filled with pea gravel. A cold patch asphalt was placed around the flush mount to match the existing pavement surface where required. If no piezometer

well was installed, the boring was backfilled with cuttings and cold patch asphalt was placed at the surface to match the existing pavement where required.

A 5-foot section of steel drill rod (2.625 inches outer diameter) and a 2.5-foot-long split spoon assembly were lost in the first attempt to drill BH-01 and could not be recovered. The exact depth of the abandoned tooling is unknown, but the top of the rod is likely between 5 and 7 feet BGS. Heaving sand was the cause of drilling difficulty that led to the loss of the tooling. Loss of tooling required that a second attempt be made to drill BH-01 to install a piezometer as planned. The second hole was drilled 4 feet to the east of the original BH-01 location and was successfully drilled directly to 15 feet BGS. A piezometer was installed.

3.4 Groundwater Monitoring

Groundwater levels were noted during drilling. Additional groundwater level measurements occurred approximately two weeks after drilling. Groundwater measurements will be collected again in the fall. Groundwater levels observed during drilling and measurements after drilling are presented on the borehole logs in Appendix A and in Table 6-1.

3.5 PID Field Testing

Soil samples, after being placed into a polyurethane bag, were tested with a Photo Ionization Detector (PID) to screen for the presence of volatile organic compounds (VOC). The PID was calibrated at the beginning of each field day with 100-parts per million (ppm) isobutylene calibration gas. The PID used was equipped with a 10.2-eV lamp.

Screening was performed between 15 and 60 minutes after the sample was placed in the bag. Prior to screening, each sample was shaken or agitated for 15 seconds to assist volatilization. After vapor development, the PID sampling probe was inserted to about one-half the headspace depth and the highest measurement was recorded. Care was taken when inserting the sampling probe into the bag to avoid uptake of any moisture or soil particles. The field PID readings are presented on the borehole logs in Appendix A.

4. Laboratory Testing and Results

Soil laboratory tests to evaluate index properties of recovered samples were performed by the Alaska Testlab (ATL) in their Anchorage facility. The laboratory testing program consisted of soil index tests to determine the water content, grain-size distribution including hydrometer, No. 200 Wash, and Atterberg Limits.

The laboratory tests were performed in accordance with the test methods of ASTM International or in-house procedure as summarized in Table 4-1.

Table 4-1. Laboratory Analyses and Methods

Analysis	Method	Number of Samples
Water Content	ASTM D2216	47
Grain-size Distribution	ASTM D6913, ASTM D422	4
Limited Mechanical Analysis	ASTM D1140 and In-House Procedure	14
Atterberg Limits	ASTM D4318	2

The Limited Mechanical Analysis (LMA) uses the No. 200 Wash following ASTM D1140 but adds the additional step of passing the retained material over the No. 4 sieve. The results provide the percentages of fines, sand, and gravel instead of just the fines content.

Results of the laboratory testing are presented in Appendix B. We note that there was a large discrepancy on BH-03 Sample 3B regarding the fines content. The discrepancy was due to the relatively small sample size compared to the amount of fines that passed the number 200 sieve. Typically, most material is washed out but sometimes fines can be retained after washing which then pass through the number 200 sieve during shaking.

5. Historical Geotechnical Investigations

CRW consulted the on-line MOA Soil Boring map to evaluate historic borings in the project area. Only one historic boring along Tasha Drive has been performed according to the MOA Boring map. A brief discussion of the historic investigation and findings are below, and the historic log is included in Appendix D.

5.1 MOA Construction Division

A single test hole was completed by the MOA in 1981 along Tasha Drive. Materials encountered consisted generally of silty sand over the full depth. The boring was completed to 9 feet BGS. Groundwater was encountered at 5 feet BGS.

6. Site Conditions

6.1 Geology

The geology for the project area was determined from the Simplified Geologic Map of Central and East Anchorage, Alaska, as mapped by R.A. Combellick with the Alaska Division of Geologic and Geophysical Surveys (DGGS) in 1999 in addition to the 1972 map by Schmoll and Dobrovolny (Combellick, 1999; Schmoll and Dobrovolny, 1972). The geology of the project area consists primarily of clay and silt of the Bootlegger Cove Clay formation. This formation contains interbedded layers of fine sand of varying thickness.

Geologic conditions in the boreholes agreed with the general geology though variations between borings were noted.

6.2 Pavement Thickness and General Soil Lithology

The pavement thickness, where encountered, ranged from 1.25 to 2.25 inches based on measurements of recovered samples.

The subsurface conditions within the existing road prism where borings occurred generally consisted of a 1.5- to 5-foot-thick layer of granular fill underlain by fine grained material. The granular fill classification was poorly graded sand with silt and gravel with a relative density between loose to medium dense. The moisture of recovered samples was moist to wet with moisture content between 4 and 14 percent. The

fines content ranged between 7 and 10 percent. The frost susceptibility was estimated to range between F-1 and F-2 frost classification.

The fine-grained material below the granular fill varied between poorly graded sand, silty sand, silt with varying sand content, and clay with consistencies of medium stiff to hard. The moisture of recovered samples was generally moist to wet with moisture content between 13 and 29 percent. Fines content ranged between 5 and 100 percent. The frost susceptibility was estimated to range from F-2 to F-4 frost classification.

The encountered subsurface conditions generally agreed with the historic geotechnical investigation boring. Detailed subsurface conditions can be found on the borehole logs in Appendix A. It should be noted that subsurface conditions outside the existing road prism could vary from the borehole logs.

6.3 Groundwater Conditions

Groundwater, if observed, is recorded on the borehole logs. Table 6-1 provides a summary of the groundwater levels at the time of drilling and subsequent measurements. All depths are relative to the existing roadway surface.

Table 6-1. Summary of Groundwater Levels

Borehole	Groundwater Levels While Drilling (feet BGS)	Groundwater Levels on 06/22/2021 (feet BGS)	Groundwater Levels on 11/22/2021 (feet BGS)	Groundwater Levels on 5/12/2022 (feet BGS)	Groundwater Levels on 9/12/2022 (feet BGS)	Groundwater Levels on 10/13/2022 (feet BGS)
BH-01	5.0	3.1	4.4	1.7	0.2	0.7
BH-02	15.0	N/A	N/A	N/A	N/A	N/A
BH-03	8.5	4.5	4.85	3.05	1.05	1.1
BH-04	15.0	N/A	N/A	N/A	N/A	N/A
BH-05	11.0	13.3	13.3	12.3	10.2	10.0

6.4 PID Field Testing Results

Standard practice in the MOA is to consider soil samples with PID readings of 20 parts per million (ppm) or higher as potentially contaminated. No readings collected at the time of the field investigation exceeded 4.5 ppm.

6.5 Contaminated Site Review

Soil samples were tested using a PID during the field investigation per MOA requirements with results previously discussed in this report and values provided on the borehole logs. In addition, CRW consulted the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Program (CSP) on-line database for nearby recorded contaminated sites. A review of the CSP database revealed no contaminated sites within 500 feet of the project area.

7. Geotechnical Engineering Recommendations

CRW has developed the following recommendations based on our understanding of the project scope and considering the data obtained during our geotechnical investigation.

7.1 Site Preparation

All pavement, existing surface soils, existing curbs and gutters, trees, stumps, and other deleterious material should be cleared. Exposed subgrade at the bottoms of excavations should be scarified a minimum of 6 inches, moisture conditioned, and recompacted. The presence of shallow groundwater will make achieving subgrade compaction difficult if dewatering efforts are not used or are ineffective.

7.2 Excavations

Any excavations for utilities should follow proper local, state, and federal requirements, including Occupational Safety and Health Administration (OSHA) standards. The soil and groundwater conditions for roadway and storm drain excavations will vary. Surface runoff entering the excavation could present challenges and should be accounted for during construction.

The contractor is responsible for trench stability, worker safety, and regulatory compliance as he will be present on a daily basis and can adjust efforts to obtain the needed stability. Shallow groundwater is present and has fluctuated considerably since the draft report. While we anticipate excavations to use benching/sloping or shielding, the contractor should be prepared to deal with considerable dewatering and potential slope stability issues. If trench shoring, like cantilever or braced excavations, is utilized, additional recommendations for lateral earth pressures can be provided.

Excavations above the water table may stand relatively steeply initially but fail without warning. As the in-situ soils dry, they will tend to ravel and slough to their natural angle of repose, which we estimate to be between 1.8 to 2.0H:1V (horizontal to vertical). Below the water table, or if surface water is allowed to enter the trench, in-situ soils may slough, soften, squeeze, slump over time or due to disturbance, to slopes of 2.5 to 3.0H:1V or flatter.

Additionally, the sequencing of excavation and roadway construction should be considered by the designers and the contractor. Should the roadway construction occur prior to the storm drain installation, poor performance of the roadway may occur due to dissimilar material in the trench compared to the roadway structural section as well as damage and repair to any insulation and/or geotextile. We recommend following the MOA Standard Specification (MASS) for the storm drain bedding, compaction, and backfill.

7.3 Dewatering and Radius of Influence

Subsurface conditions have shallow groundwater based on our measurements relative to the anticipated storm drain excavation. Excavations are anticipated to be 4 to 8 feet BGS and groundwater levels were measured between 0.2 to 13.3 feet BGS. Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales. We recommend that the contractor determine the actual groundwater levels prior to construction to evaluate groundwater impacts on the construction procedures, as necessary. We recommend the ground around any excavation be contoured to direct surface water away from the excavation and to minimize surface water or runoff from entering the excavation.

Based on the observed groundwater and anticipated excavation depths, dewatering will likely be required. Dewatering methods include open pumping, wellpoints, deep wells, ejector wells, cutoff methods, or some combination. Considering the lithology encountered and anticipated depths, we do not recommend open pumping, ejector wells, or cutoff methods due to the anticipated groundwater drainage potential based on estimated hydraulic conductivity (discussed below) (see Powers et al., 2007 and Powrie, 2014). We recommend wellpoints be considered for construction dewatering. Depending on spacing and size, wellpoints are expected to be 1.5- or 2-inch diameter.

We recommend construction dewatering be the responsibility of the contractor, including submitting a dewatering plan for approval as part of the submittal process. The dewatering plan should show anticipated wellpoint/well layout including spacing, diameters, well screens, filters, location of pumps, and discharge point(s).

Permits from the Alaska Department of Natural Resources and potentially other local and state agencies will be necessary for construction dewatering.

For preliminary planning, we have estimated pumping rates for the storm drain excavation based on an assumed dewatering both sides of an effective trench width of 6 feet, drawdown of 7 feet, and depth to confining layer of 50 feet. We estimated hydraulic conductivity from empirical and literature values, based on the encountered soils, ranging from 0.5 to 60 FT/day with higher flows in the sands and lower flows in the silt with sand. We note there is tremendous uncertainty in conductivity estimates using empirical/literature values as they are affected by soil type, excavation/dewatering methods, and seasonal groundwater fluctuations and will vary during construction.

We estimate an initial required pumping rate of 1.0 to 10 gallons per minute per linear foot (GPM/FT) which decreases to steady-state pumping rates of 0.5 to 5 GPM/FT during dewatering efforts. We estimate the radius of influence of the cone of depression from dewatering to vary from 20 to 200 FT (measured from the center of the trench) using wellpoints. Higher radius of influence will likely occur if shallow or deep wells are used. These estimates do not consider the effect of “tailwater” from water flowing into the excavation due to the high permeability of bedding material.

Dewatering activities should consider the potential for settlement if buildings and other infrastructure are within the radius of influence. When the water table is lowered, compressible soils can consolidate, due to an increase of the effective weight of overlying soils. Consolidation has the potential to impact development adjacent to the project area. While construction and dewatering are anticipated to be of short duration and impacts minimal, considerations should be made as to whether monitoring of settlement is required. CRW’s geotechnical engineer will work closely with the designers to evaluate the magnitude of settlement and tolerable settlement values will be determined considering input from MOA, CRW designers, and stakeholders during detailed design.

If dewatering is anticipated to produce unacceptable settlements, the designers should perform pre- and post-condition surveys of the building finish floors/foundations and other infrastructure to evaluate if dewatering activities resulted in damage. In addition, survey points should be placed at and around buildings and other infrastructure to verify settlement due to dewatering. If settlement is observed during monitoring the contractor should reevaluate the dewatering technique to reduce the potential for continued settlement.

7.4 Frost Depth and Permafrost

Typical design frost depths are estimated between 8 and 11 feet BGS in Anchorage though seasonal fluctuations of snow cover, temperatures, infiltration/evaporation, groundwater table, and other climatic

effects influence this depth. Therefore, any calculated value should only be considered a reasonably estimated value as deeper frost penetrations are possible. In addition, the presence of groundwater within the upper 11 feet will also affect the frost depth and the potential for ice lensing and heaving.

Permafrost was not encountered in the boreholes and is not expected at the project site.

7.5 Recommended Road Structural Section

CRW has developed a recommended road structural section based on the current MOA DCM as outlined in Chapter 1 Streets, Section 1.10 Road Structural Fill Design. The structural section design uses the goal of reducing the freezing and thawing impacts to a specified percentage as the controlling design criteria. As such, no traffic analysis-based pavement design is considered here.

The DCM recommends two methods for frost considerations in the structural section design: the Complete Protection Method and the Limited Subgrade Frost Penetration Method.

The Complete Protection Method involves the removal of all frost susceptible subgrade soils beneath the roadway to the calculated frost penetration depth. These soils are replaced with non-frost susceptible (NFS) fill. This method may be used regardless of the frost susceptibility of the subgrade soils. Rigid board insulation may also be used in the subbase of the structural section to reduce the required depth of classified fill and backfill. The Complete Protection Method would require excavation and replacement of frost susceptible soils down to depths of 8 to 10 feet, excluding insulation. This method is not economical and therefore is not recommended.

The Limited Subgrade Frost Penetration Method attempts to restrict roadway surface movements to levels that will not adversely affect road surface life or quality. The method per the DCM permits frost penetration into a frost susceptible subgrade equal to a maximum of 10 percent of the structural section design thickness.

The frost depth was analyzed using the commercially available MSDOS computer program BERG2 written by Braley and Connor (Braley and Connor, 1989) as approved in the DCM. The analysis calculates the estimated total frost penetration depth and is used to determine the required structural section thickness. For our analysis, we used the program default historic climate parameters for Anchorage and assumed conservative surface freeze/thaw n-factors based on local practice and published values. Soil layers were assigned in the program with estimated dry unit weights of the soil and average measured or anticipated water contents. Soil thermal parameters were calculated from the equations built into the BERG2 program (see Braley and Connor for further discussion).

7.5.1 Recommended Structural Section – Limited Subgrade Frost Protection Method

The project area contains frost susceptible subgrade with F-2 to F-4 frost classification within 8 feet of the ground surface. Based on this, we recommend an insulated structural section using the Limited Subgrade Frost Penetration for the entire project alignment. We have developed a recommended structural section based on the BERG2 analysis and have evaluated using 2 inches of insulation. The insulation for the structural section in this analysis assumed a minimum R-value of R-4.5 per inch. Our recommended structural sections are presented in Table 7-1 based on MASS. A typical insulated section is presented in Figure 3.

Table 7-1. Recommended Structural Section – 2 inches Insulation

Layer	Minimum Thickness, inches
Asphalt Pavement	2
Leveling Course	2
MOA Type II-A	16
Insulation	2
MOA Type II	24
Geotextile	Separation (not included in thickness determination)
Subgrade	Existing (not included in thickness determination)
Total Thickness	*46*

See Appendix E for BERG2 analysis and detailed results. Note that the recommended structural section considers only minimum thicknesses.

7.6 Compaction Requirements

Pavement structural section fill material should be placed in loose lifts, no more than 12 inches in thickness, and compacted to a minimum of 95 percent of the Modified Proctor maximum dry density in accordance with ASTM D1557. Compaction verification of the backfill by a qualified inspector is also recommended.

7.7 Rigid Insulation

We recommend that rigid board insulation for the road structural section have a minimum compressive strength of 60 pounds per square inch (psi) and a maximum water absorption of 0.3 percent by volume in accordance with the current version of MASS. We recommend the insulation have a minimum R-value of R-4.5 per inch. We recommend a minimum of 12 inches of loose fill be placed over the insulation before any construction equipment drives over the insulation, to protect from wheel loads during construction. We recommend a minimum of 16 inches of fill over the insulation for design to prevent frost formation in the form of differential icing at the pavement surface.

Board insulation installation should be extended a minimum of 4 feet beyond the back of the curb when no pathway/sidewalk is present. Extending the insulation 4 feet will reduce the risk of the curb heaving up or “curb jacking”. The potential for curb jacking decreases as the distance the insulation extends beyond the back of curb increases. The 4-foot layout has protected the curb well on past projects especially where the curbs need to be protected due to the flat longitudinal roadway grades like those on this project.

The insulation should extend 1 foot minimum beyond the back of any sidewalk/pathway but the sidewalk/pathway will not perform as well as the curb, see Figure 3. To increase the performance of any sidewalk/pathway, the owner could consider extending the insulation 4 feet beyond the back of sidewalk/pathway as well. Additionally, insulation below pathways that are separated from the back of curb by 4 feet or more could be reduced to R-4.5 per inch to save cost, but the separated pathway will not perform as well.

Transitions between insulated and non-insulated sections should involve the extension of insulation beyond the roadway section 8 to 12 feet with the thickness reduced in these areas to minimize the possibility of differential heave. The insulation can be tapered from an R-value of 9 to an R-value of 4.5 in the transition zone. The subgrade in transitions should be graded (tapered) at a 10H:1V (horizontal to vertical) slope if construction distances permit. We recommend the transitions not be steeper than 5H:1V.

7.8 Geotextiles

We recommend that a geotextile be used at the base of the structural section along the entire project alignment. The use of a geotextile reduces the effects of thaw weakening, prevents fines migration, and increases lateral drainage at the base of the structural section, see Figure 3. If soil layers at the base of the excavation are loose or soft, the geotextile will provide additional stabilization.

We recommend using a non-woven geotextile meeting MOA specifications similar to Class 2, Type A. The geotextile should be placed on top of the excavated subgrade soils prior to placement of classified fill. The geotextile should be extended up the sides of excavations.

Typical installation involves placing the geotextile transverse to the centerline in order to avoid large overlaps. Fabric joints should be overlapped according to manufacturer's recommendations. Fabric joints may require sewing together depending on subgrade conditions and should follow the manufacturer's requirements.

7.9 Subdrains

Incorporation of subdrains into the design of the structural section is recommended to help mitigate the effects of high ground water levels. High groundwater levels, or groundwater that reaches the pavement structural section, can collect in the structural section and impact the overall road performance. Subdrains will mitigate water infiltration in the structural section and improve overall road performance. The depth of subdrain installation should be below insulation to prevent seasonal freezing of the subdrain.

Edge drains should be placed at the outer edges of the structural section as shown in Figure 3 and consist of a geotextile wrapped perforated PVC Pipe with a minimum O.D. of 4 inches. Construction should be per MASS Specifications. Roadway subgrade should be sloped with a minimum of 2 percent towards subdrains to assist with drainage. Termination of the subdrains should be to the drainage system manholes or suitable outfalls. Subdrains should be hydraulically sized and consider potential icing issues.

Should edge drains not be feasible, an alternative would be a perforated drain placed in a shallow trench near the center of the structural section. Additional recommendations can be provided if this alternative is required.

7.10 Reuse of Material

Fill and native material that meets the classification for MOA Type II and Type II-A fill can be reused as classified fill in the roadway structural section. It is anticipated that the majority of existing soils along the project alignment contain frost susceptible material and will not meet MOA Type II and Type II-A classification. Existing materials may be used for backfill material where non-classified fill is permissible.

The amount and quality of reuse of material will vary depending on factors including lateral extent of deposits, transitional lithology, degree of saturation and moisture control during construction, and mixing of excavated materials. Higher fines content soils were encountered near the ground surface which could make granular soils difficult to compact if mixed and water content increases. We recommend native material excavated for reuse be visually inspected for fines content, and if the material becomes wet, it

will require storage to be dried for reuse. This effort may be less efficient and cost more than complete removal and replacement with imported materials.

8. Limitations and Closure

The information submitted in this report is based on our interpretation of data from a field geotechnical investigation performed for this project. The conclusions contained in this report are based on site conditions as they were observed on the drilling dates indicated. It is presumed that the borings in this investigation are representative of the subsurface conditions throughout the site. Effort was made to obtain information representative of existing conditions at the site. If, however, subsurface conditions are found to differ, we should be notified immediately to review these recommendations in light of additional information.

If there is substantial lapse of time between the submittal of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we recommend that this report be reviewed to determine the applicability of the conclusions considering the changed conditions and time lapse. Unanticipated soil conditions are commonly encountered and cannot fully be determined by collecting discrete samples or advancing borings. The client and contractor should be aware of this risk and account for contingency accordingly.

Samples will be retained by CRW for six months following the date on which the final report is issued. Other arrangements may be made at the client's request.

This report was prepared by CRW for use on this project only and may not be used in any manner that would constitute a detriment to CRW. CRW is not responsible for conclusions, opinions, or recommendations made by others based on data presented in this report.

9. References

Braley, W.A. and Connor, B., 1989. Berg2 Micro-Computer Estimation of Freeze and Thaw Depths and Thaw Consolidation. A report prepared for the State of Alaska Department of Transportation and Public Facilities Statewide Research. June.

Combellick, R.A., 1999. Simplified geologic map and cross sections of central and east Anchorage, Alaska: Alaska Division of Geological and Geophysical Surveys Preliminary Interpretive Report 1999-1.

Powers, P.J., Corwin, A.B., Schmall, P.C., and Kaeck, W.E., 2007. Construction Dewatering and Groundwater Control, 3rd Edition. John Wiley & Sons, Inc., Hoboken, NJ.

Powrie, W., 2014. Soil Mechanics Concepts and Applications, 3rd Edition. Taylor and Francis Group, LLC, Boca Raton, FL.

Schmoll, H.R. and Dobrovolny, E., 1972. Generalized Geologic Map of Anchorage and Vicinity, Greater Anchorage Area Borough, Alaska. US. Geological Survey Open File Report: Technical Data Unit Classification number 513.

Figures

File Path: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\04 GIS\10150_F1_VicinityMap_rev.mxd

CRW ENGINEERING GROUP LLC
3490 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

TASHA DRIVE RECONSTRUCTION
GEOTECHNICAL INVESTIGATION
VICINITY MAP
ANCHORAGE, ALASKA

Project:	10150.00
Drawn By:	AFS
Scale:	Graphical Scale
Date:	10/21/2022
Figure:	1

LEGEND

1 Parcel Lines with Project Parcel Designations

SOIL BORINGS

- Historical Soil Borings (MOA Database)
- Geotechnical Boring (2021)
- Geotechnical Boring Completed as Piezometer (2021)

First attempt of BH-01 four feet west of piezometer. Abandoned tooling at approximately 5-7 feet BGS.

FLAMINGO DRIVE

KATHLEEN DRIVE

TASHA DRIVE

NORTHWOOD STREET

BH-01

BH-02

BH-03

BH-04

BH-05

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

N

0 100 200 Feet

File Path: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\04 GIS\10150_F2_ Borehole_Locations.mxd

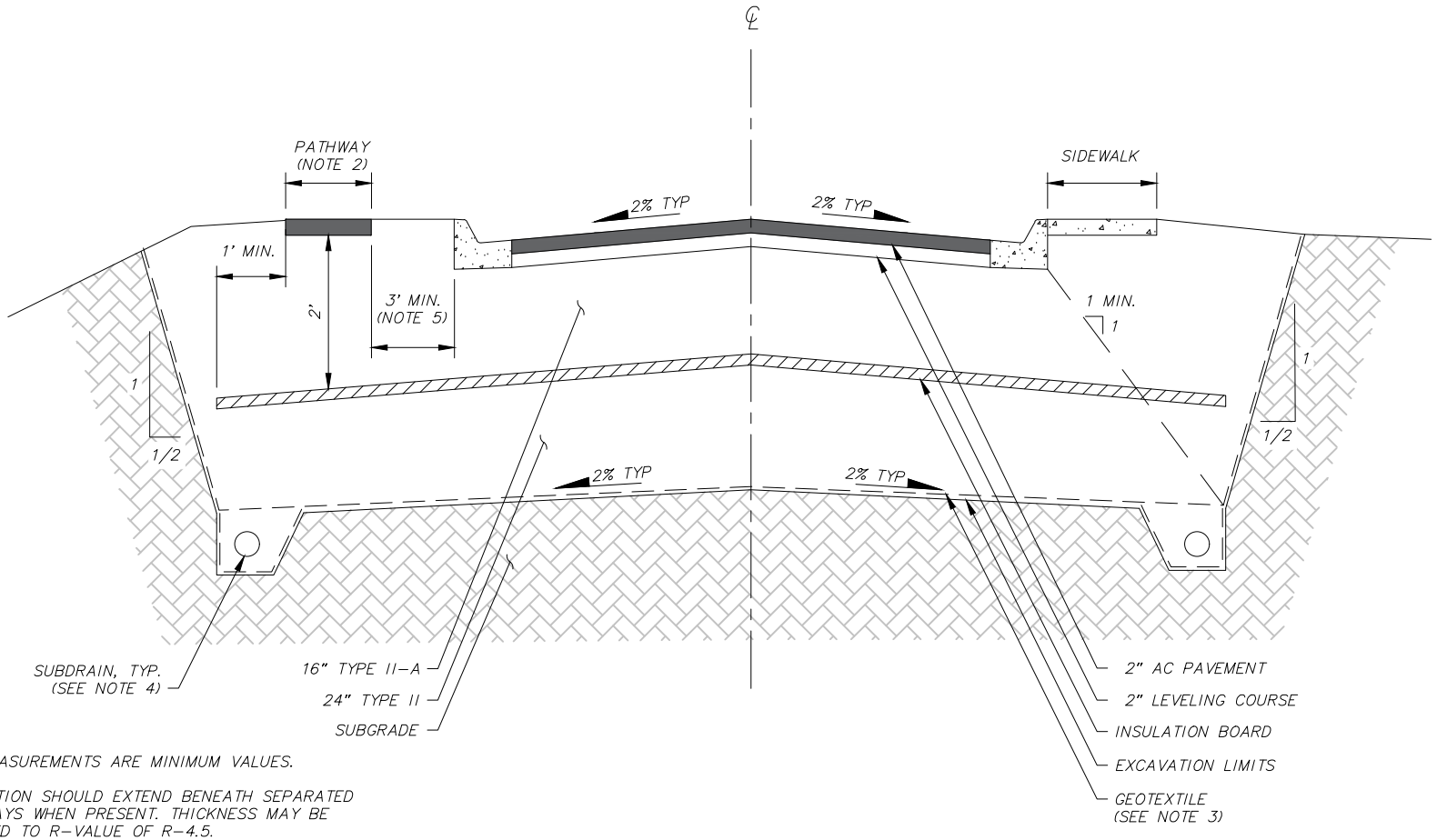
CRW ENGINEERING GROUP, LLC
3490 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

TASHA DRIVE RECONSTRUCTION: GEOTECHNICAL EXPLORATION

BOREHOLE LOCATIONS

ANCHORAGE, ALASKA

Project:	10150.00
Drawn By:	AFS
Scale:	Graphic
Date:	10/21/2022
Figure:	2



NOTES:

1. ALL MEASUREMENTS ARE MINIMUM VALUES.
2. INSULATION SHOULD EXTEND BENEATH SEPARATED PATHWAYS WHEN PRESENT. THICKNESS MAY BE REDUCED TO R-VALUE OF R-4.5.
3. GEOTEXTILE SHALL MEET MOA MASS SECTION 20.25 CLASS 2, TYPE A, NON-WOVEN FABRIC WHEN SPECIFIED.
4. INSTALL SUBDRAINS PER M.A.S.S. DETAIL #55-3.
5. EXTEND INSULATION A MINIMUM OF 4 FEET BEYOND THE BACK OF CURB WHEN NO PATHWAY OR SIDEWALK ARE PRESENT.
6. INSULATION MIN. 60 PSI, ABSORPTION 0.30% MAX. BY VOLUME PER M.A.S.S.

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

TASHA DRIVE RECONSTRUCTION
MOA PM&E NO 20-15

TYPICAL INSULATED SECTION
WITH EDGE SUBDRAINS

Project No:	10150.00
Drawn By:	SMH
Scale:	NTS
Date:	OCT. 2022
Figure:	3

Appendix A

Borehole Logs

Included in this section:

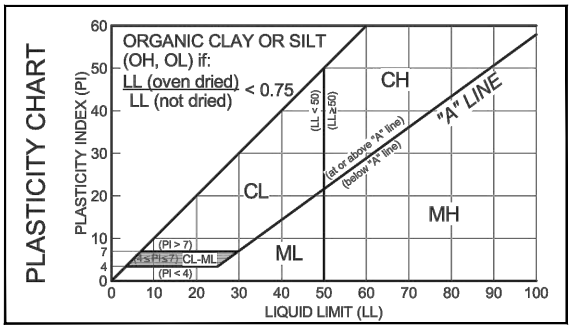
1) Borehole Log Legend
2) Borehole Logs (BH-01 through BH-05)

UNIFIED SOIL CLASSIFICATION (ASTM D 2487)

GROUP SYMBOL	SOIL GROUP NAMES & LEGEND	
GW	WELL-GRADED GRAVEL	If soil contains ≥ 15% sand, add "with sand"
GP	POORLY GRADED GRAVEL	
GM	SILTY GRAVEL	
GC	CLAYEY GRAVEL	
SW	WELL-GRADED SAND	If soil contains ≥ 15% gravel, add "with gravel"
SP	POORLY GRADED SAND	
SM	SILTY SAND	
SC	CLAYEY SAND	
CL	LEAN CLAY	If soil contains coarse-grained soil from 15% to 29%, add "with sand" or "with gravel" for whichever type is prominent, or for ≥30%, add "sandy" or "gravelly"
ML	SILT	
OL	ORGANIC CLAY OR SILT	
CH	FAT CLAY	
MH	ELASTIC SILT	
OH	ORGANIC CLAY OR SILT	
PT	PEAT	

Gravels or sands with 5% to 12 % fines require dual symbols (GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC) and add "with clay or "with silt" to group name. If fines classify as CL-ML for GM or SM, use dual symbol GC-GM or SC-SM.

Optional Abbreviations: Lower case "s" after USCS group symbol denotes either "sandy or "with sand" and "g" denotes either "gravelly" or "with gravel."



COMPONENT DEFINITIONS BY GRADATION

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 IN.
COBBLES	3 IN. TO 12 IN.
GRAVEL	3 IN. TO NO. 4 (4.76 mm)
COARSE GRAVEL	3 IN. TO 3/4 IN.
FINE GRAVEL	3/4 IN. TO NO. 4 (4.76 mm)
SAND	NO. 4 (4.76 mm) TO NO. 200 (0.074 mm)
COARSE SAND	NO. 4 (4.76 mm) TO NO. 10 (2.0 mm)
MEDIUM SAND	NO 10 (2.0 mm) TO NO. 40 (0.42 mm)
FINE SAND	NO. 40 (0.42 mm) TO NO. 200 (0.074 mm)
SILT AND CLAY	SMALLER THAN NO. 200 (0.074 mm)
SILT	0.074 mm TO 0.005 mm
CLAY	LESS THAN 0.005 mm

DESCRIPTIVE TERMINOLOGY FOR PERCENTAGES (ASTM D 2488)

DESCRIPTIVE TERMS	RANGE OF PROPORTION
TRACE	0 - 5%
FEW	5 - 10%
LITTLE	10 - 25%
SOME	30 - 45%
MOSTLY	50 - 100%

RELATIVE DENSITY / CONSISTENCY ESTIMATE USING STANDARD PENETRATION TEST (SPT) VALUES (FROM TERZAGHI & PECK 1996)

COHESIONLESS SOILS[a]		COHESIVE SOILS[b]		
RELATIVE DENSITY	N_{60} (BLOWS/FOOT)[c]	CONSISTENCY	N_{60} (BLOWS/FOOT)[c]	UNCONFINED COMPRESSIVE STRENGTH (TSF)[d]
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MED DENSE	10 - 30	MEDIUM	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

(a) Soils consisting of gravel, sand and silt, either separately or in combination possessing no characteristics of plasticity, and exhibiting drained behavior.
(b) Soils possessing the characteristics of plasticity, and exhibiting undrained behavior.
(c) Refer to ASTM D 1586-99 for a definition of N.
(d) Undrained shear strength, s_u = 1/2 unconfined compression strength, U_c. Note that Torvane measures s_u and Pocket Penetrometer measures U_c.

CRITERIA FOR DESCRIBING MOISTURE CONDITION (ASTM D 2488)

DRY	ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST	DAMP BUT NO VISIBLE WATER
WET	VISIBLE FREE WATER, USUALLY SOIL IS BELOW WATER TABLE

SAMPLER ABBREVIATIONS

SS	SPT Sampler (2 in. OD, 140 lb hammer)	C	Core (Rock)
SSO	Oversize Spit Spoon (2.5 in. OD, 140 lb typ.)	TW	Thin Wall (Shelby Tube)
HD	Heavy Duty Split Spoon (3 in. OD, 300/340 lb typ.)	MS	Modified Shelby
BD	Bulk Drive (4 in. OD, 300/340 lb hammer typ.)	GP	Geoprobe
CA	Continuous Core (Soil in Hollow-Stem Auger)	AR	Air Rotary Cuttings
G	Grab Sample from surface / testpit	AG	Auger Cuttings

LABORATORY TEST ABBREVIATIONS

Consol	Consolidation	PM	Modified Proctor	TXCD	Consolidated Drained Triaxial
Dd	Dry Density	PP	Pocket Penetrometer	TXCU	Consolidated Undrained Triaxial
MA	Sieve and Hydrometer Analysis	MC	Moisture Content	TXUU	Unconsolidated Undrained Triaxial
NP	Non-plastic	SA	Sieve Analysis	LL	Liquid Limit
OLI	Organic Loss	SpG	Specific Gravity	PL	Plastic Limit
P200	Percent Fines (Silt & Clay)	TS	Thaw Consolidation	VS	Vane Shear
PID	Photoionization Detector	TV	Torvane	Ω	Soil Resistivity

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

SOIL CLASSIFICATION / LEGEND

FIGURE A-1

FILE NAME: M:\Engineering_References\Tech_Geotechnical\Alaska Geotechnical Reports\Geotech.dwg

FROZEN SOIL CLASSIFICATION (ASTM D 4083)

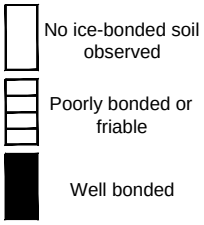
1. DESCRIBE SOIL INDEPENDENT OF FROZEN STATE	CLASSIFY SOIL BY THE UNIFIED SOIL CLASSIFICATION SYSTEM				
	MAJOR GROUP		SUBGROUP		
	DESCRIPTION	DESIGNATION	DESCRIPTION		DESIGNATION
2. MODIFY SOIL DESCRIPTION BY DESCRIPTION OF FROZEN SOIL	Segregated ice not visible by eye	N	Poorly bonded of friable		N_f
			Well bonded	No excess ice	Nbn
				Excess ice	Nbe
	Segregated ice visible by eye (ice less than 25 mm thick)	V	Individual ice crystals or inclusions		V_x
			Ice coatings on particles		V_c
			Random or irregularly oriented ice formations		V_r
			Stratified or distinctly oriented ice formations		V_s
			Uniformly distributed ice		V_u
3. MODIFY SOIL DESCRIPTION BY DESCRIPTION OF SUBSTANTIAL ICE STRATA	Ice greater than 25 mm thick	ICE	Ice with soil inclusions		ICE+soil type
			Ice without soil inclusions		ICE

FROST DESIGN SOIL CLASSIFICATION[1]

FROST GROUP[2]	GENERAL SOIL TYPE	% FINER THAN 0.02 mm BY WEIGHT	TYPICAL USCS SOIL CLASS
NFS[3]	(a) Gravels Crushed stone Crushed rock	0 - 1.5	GW, GP
	(b) Sands	0 - 3	SW, SP
PFS[4] [MOA NFS]	(a) Gravels Crushed stone Crushed rock	1.5 - 3	GW, GP
[MOA F2]	(b) Sands	3 - 10	SW, SP
S1 [MOA F1]	Gravelly soils	3 - 6	GW, GP, GW-GM, GP-GM, GW-GC, GP-GC
S1 [MOA F2]	Sandy soils	3 - 6	SW, SP, SW-SM, SP-SM, SW-SC, SP-SC
F1[5]	Gravelly soils	6 - 10	GM, GC, GM-GC, GW-GM, GP-GM, GW-GC, GP-GC
F2[5]	(a) Gravelly soils	10 - 20	GW, GP, GW-GM, GP-GM, GW-GC, GP-GC
	(b) Sands	6 - 15	SM, SW-SM, SP-SM, SC, SW-SC, SP-SC, SM-SC
F3[5]	(a) Gravelly soils	10 -20	GM, GC, GM-GC
	(b) Sands, except very fine silty sands	6 - 15	SM, SC, SM-SC
	(c) Clays, PI>12	--	CL, CH
F4[5]	(a) Silts	--	ML, MH, ML-CL
	(b) Very fine silty sands	Over 15	SM, SC, SM-SC
	(c) Clays, PI<12	--	CL, ML-CL
	(d) Varved clays or other fine-grained banded sediments	--	CL or CH layered with ML, MH, ML-CL, SM, SC, or SM-SC

(1) From the U.S. Army Corps of Engineers (USACE), EM 1110-3-138, "Pavement Criteria for Seasonal Frost Conditions", April 1984
(2) USACE frost groups directly correspond to frost groups in Municipality of Anchorage (MOA) Design Criteria Manual (DCM).
(3) Non-frost susceptible
(4) Possibly frost susceptible, requires lab test for void ratio to determine frost design classification.
(5) Consistent with MOA Definition.

ICE BONDING SYMBOLS



DEFINITIONS

Candled Ice is ice which has rotted or otherwise formed into long columnar crystals, very loosely bonded together.

Clear Ice is transparent and contains only a moderate number of air bubbles.

Cloudy Ice is translucent, but essentially sound and non-pervious.

Friable denotes a condition in which material is easily broken up under light to moderate pressure.

Granular Ice is composed of coarse, more or less equidimensional, ice crystals weakly bonded together.

Ice Coatings on particles are discernible layers of ice found on or below the larger soil particles in a frozen soil mass. They are sometimes associated with hoarfrost crystals, which have grown into voids produced by the freezing action.

Ice Crystal is a very small individual ice particle visible in the face of a soil mass. Crystals may be present alone or in a combination with other ice formations.

Ice Lenses are lenticular ice formations in soil occurring essentially parallel to each other, generally normal to the direction of heat loss and commonly in repeated layers.

Ice Segregation is the growth of ice as distinct lenses, layers, veins and masses in soils, commonly but not always oriented normal to direction of heat loss.

Massive Ice is a large mass of ice, typically nearly pure and relatively homogeneous.

Poorly-Bonded signifies that the soil particles are weakly held together by the ice and that the frozen soil consequently has poor resistance to chipping or breaking.

Porous Ice contains numerous void, usually interconnected and usually resulting from melting at air bubbles or along crystal interfaces from presence of salt or other materials in the water, or from the freezing of saturated snow. Though porous, the mass retains its structural unity.

Thaw-Stable frozen soils do not, on thawing, show loss of strength below normal, long-time thawed values nor produce detrimental settlement.

Thaw-Unstable frozen soils show on thawing, significant loss of strength below normal, long-time thawed values and/or significant settlement, as a direct result of the melting of the excess ice in the soil.

Well-Bonded signifies that the soil particles are strongly held together by the ice and that the frozen soil possesses relatively high resistance to chipping or breaking.

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

FROZEN SOIL CLASSIFICATION / LEGEND

FIGURE A-2

FILE NAME: M:\Engineering_References\Tech_Geotechnical\Alaska Geotechnical Reports\Geotech.dwg

CRW Engineering Group, LLC
3940 Arctic Blvd Ste 300
Anchorage Alaska 99503
Telephone: (907) 562-3252

BOREHOLE BH-01

CLIENT Municipality of Anchorage
PROJECT NAME Tasha Drive Reconstruction
PROJECT NUMBER MOA PM&E Project No. 20-15
PROJECT LOCATION Anchorage, Alaska
DATE STARTED 6/2/21 **COMPLETED** 6/2/21
GROUND ELEVATION
DRILLING CONTRACTOR Discovery Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow-Stem Auger
AT TIME OF DRILLING 5.00 ft
LOGGED BY AFS **CHECKED BY** SMH
AT END OF DRILLING --- Silt slurry from drilling prevented gauging.
NOTES First abandoned attempt at BH-01 is 4 feet west of piezometer.
AFTER DRILLING 0.70 ft 10/13/2022

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	FIELD BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ICE BOND	PID (ppm)	OTHER TESTS
0			1.5 inches asphalt, intensely cracked.							
	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 25% gravel, 65% sand, 10% fines Brown, moist to wet, no odor. Gravel subangular to subrounded up to 1.5 inches. Silt lens at bottom of spoon. Frost class F-2 (estimated).	HD S1A	92	4-4-4-3 (8)			2.2	SA
				HD S1B					0.6	LMA
	SM		SILTY SAND, (SM) 12% gravel, 49% sand, 39% fines Brown, moist, no odor. Frost class F-3 (estimated).	HD S2A	75	2-3-3-3 (6)			1.8	
	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 26% gravel, 63% sand, 11% fines Brown, moist to wet, no odor. Similar in appearance to soil beneath the asphalt. Gravel up to 1.5 inches. Frost class F-2 (estimated).	HD S2B					1.6	LMA
5				HD S3A					1.5	
	ML		SILT, (ML) 0% gravel, 1% sand, 99% fines Brown transitioning to gray with depth, moist, no odor, non-plastic. Frost class F-4 (hydrometer).	HD S3B	100	3-3-4-9 (7)			1.4	MA
	ML		SILT, (ML) 0% gravel, 5% sand, 95% fines Gray, moist, no odor, non-plastic. Frost class F-4 (estimated).	HD S4	67	3-10-9-8 (19)			2.3	LMA
10			VS 46.0/8.4 psf	HD S5A	100	4-3-7-11 (10)	2.5		2.2	
			VS 33.4/8.4 psf				2.75 1.5 1.75			
			VS 58.5/23.0 psf	HD S5B			1.75 1.75		2.8	
	SP		POORLY GRADED SAND, (SP) 5% gravel, 90% sand, 5% fines Gray, moist to wet, no odor. Medium sand. Gravel subangular up to 0.75 inches at interface with silt.							
15										
	CL		LEAN CLAY, (CL) 0% gravel, 0% sand, 100% fines Gray, soft, moist, no odor, medium plasticity. Very little clay recovered in spoon. Slough and heaved sand (S6A and S6B, not presented on log) were majority of soil present in sample.	HD S6C	8	11-4-3-3 (7)			1.6	

▲ FIELD N VALUE ▲ 10 20 30 40
PL MC LL 10 20 30 40

Bottom of borehole at 17.0 feet.

Notes:
Completed as standpipe piezometer in the second hole drilled at this location, 1" Sch40 PVC, hand-slotted screen 2.5-14.5 ft BGS. Backfilled with cuttings. Steel flushmount monument with 1/2" bolts.
First hole lost due to heaving sands and hole collapse.

A section of drill rod and a spoon assembly was lost in the first attempt and was abandoned. Top of the rod is likely between 5 and 7 feet BGS.

CRW Engineering Group, LLC
3940 Arctic Blvd Ste 300
Anchorage Alaska 99503
Telephone: (907) 562-3252

BOREHOLE BH-02

CLIENT Municipality of Anchorage
PROJECT NAME Tasha Drive Reconstruction
PROJECT NUMBER MOA PM&E Project No. 20-15
PROJECT LOCATION Anchorage, Alaska
DATE STARTED 6/2/21 **COMPLETED** 6/2/21
GROUND ELEVATION
DRILLING CONTRACTOR Discovery Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow-Stem Auger
▽ **AT TIME OF DRILLING** 15.00 ft
LOGGED BY AFS **CHECKED BY** SMH
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	FIELD BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ICE BOND	PID (ppm)	OTHER TESTS	▲ FIELD N VALUE ▲ 10 20 30 40 / PL MC LL 10 20 30 40
0			1.25 inches asphalt.								
	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 22% gravel, 69% sand, 9% fines Brown, moist, no odor. Gravel subrounded up to 2 inches. Frost class F-2 (estimated).	HD S1	75	5-5-5-4 (10)			2.6	LMA	▲○
				HD S2	75	4-3-4-3 (7)			3.1		▲ ○
5	SM		SILTY SAND, (SM) 10% gravel, 63% sand, 27% fines Brown, moist, no odor. Light brown silt lenses. Gravel rounded up to 1 inch. Medium sand. Frost class F-2 (estimated).	HD S3	67	5-4-3-2 (7)			2.8	LMA	▲ ○
	SM		SILTY SAND, (SM) 0% gravel, 80% sand, 20% fines Gray, moist, no odor. Frost class F-2 (estimated). VS 58.5/5.2 psf	HD S4	100	6-8-9-11 (17)	3.0 2.25 4.0		1		▲ ○
10	ML		SILT, (ML) 0% gravel, 5% sand, 95% fines Gray, moist, no odor, non-plastic. VS 50.1/23.0 psf VS 46.0/10.4 psf VS 75.2/25.1 psf	HD S5	75	9-9-4-7 (13)	3.5 2.75 3.75 >4.5 4.5 3.0 3.25		1.7	AL	▲ ○
15	SP	▽	POORLY GRADED SAND, (SP) 10% gravel, 85% sand, 5% fines Gray, wet, no odor. Medium sand. Gravel up to 0.75 inches.	HD S6	92	20-8-7-8 (15)			2.5		▲ ○

Bottom of borehole at 17.0 feet.

Notes:
Backfilled with cuttings, cold patch.

CRW Engineering Group, LLC
3940 Arctic Blvd Ste 300
Anchorage Alaska 99503
Telephone: (907) 562-3252

BOREHOLE BH-03

CLIENT Municipality of Anchorage
PROJECT NAME Tasha Drive Reconstruction
PROJECT NUMBER MOA PM&E Project No. 20-15
PROJECT LOCATION Anchorage, Alaska
DATE STARTED 6/2/21 **COMPLETED** 6/2/21
GROUND ELEVATION
DRILLING CONTRACTOR Discovery Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow-Stem Auger
AT TIME OF DRILLING 8.50 ft
LOGGED BY AFS **CHECKED BY** SMH
AT END OF DRILLING --- Silt slurry from drilling prevented gauging.
NOTES
AFTER DRILLING 1.10 ft 10/13/2022

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	FIELD BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ICE BOND	PID (ppm)	OTHER TESTS
0			2.25 inches asphalt.							
	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 35% gravel, 50% sand, 15% fines. Brown, moist, no odor. Gravel up to 2 inches. Silt lenses. Frost class F-2 (estimated).	HD S1	100	8-8-6-7 (14)			3.5	
	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 35% gravel, 57% sand, 8% fines. Brown, moist, no odor. As above, except no silt lenses. Frost class F-2 (estimated).	HD S2A	83	6-4-3-3 (7)			4.1	LMA
				HD S2B			>4.5		2.6	LMA
5	ML		SILT WITH SAND, (ML) 0% gravel, 17% sand, 83% fines. Tan, moist, no odor, stiff, low plasticity. Sand partings. Frost class F-4 (estimated). VS 196.4/58.5 psf	HD S3A	92	4-6-8-8 (14)	3.75		2.8	
	ML		VS 137.9/20.9 psf. SILT WITH SAND, (ML) 3% gravel, 14% sand, 83% fines. Brown, moist, no odor. Gravel up to 0.5 inches and coarse sand along interface with silt. Frost class F-4 (hydrometer).	HD S3B			2.75		3	MA
	SM		SILTY SAND, (SM) 0% gravel, 75% sand, 25% fines. Tan, moist to wet, no odor. Frost class F-2 (estimated).	HD S4	83	8-9-11-10 (20)			2.6	
10	ML		SILT WITH SAND, (ML) 0% gravel, 25% sand, 75% fines. Gray-brown, moist, no odor.	HD S5A	100	7-7-8-9/2"			3.9	>>
				HD S5B			>4.5		2.1	
	CL		LEAN CLAY, (CL) 0% gravel, 10% sand, 90% fines. Gray, moist to wet, no odor, stiff, low plasticity. Interbedded sandy clay and clayey sand. VS 98.2/8.4 psf							
15			VS 156.7/20.9 psf	HD S6A	100	10-8-15-20 (23)	3.25 3.75 4.5 3.25		2.5	AL
	SP		VS 91.9/41.8 psf. POORLY GRADED SAND, (SP) 0% gravel, 95% sand, 5% fines. Gray, moist, no odor.	HD S6B					3.6	

Bottom of borehole at 17.0 feet.

Notes:
Completed as standpipe piezometer, 1" Sch40 PVC, hand-slotted screen 2.5-12.5 ft BGS. Backfilled with cuttings. Steel flushmount monument with 1/2" bolts.

▲ FIELD N VALUE ▲
10 20 30 40
PL MC LL
10 20 30 40

CRW Engineering Group, LLC
3940 Arctic Blvd Ste 300
Anchorage Alaska 99503
Telephone: (907) 562-3252

BOREHOLE BH-04

CLIENT Municipality of Anchorage
PROJECT NAME Tasha Drive Reconstruction
PROJECT NUMBER MOA PM&E Project No. 20-15
PROJECT LOCATION Anchorage, Alaska
DATE STARTED 6/2/21 **COMPLETED** 6/2/21
GROUND ELEVATION
DRILLING CONTRACTOR Discovery Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow-Stem Auger
▽ **AT TIME OF DRILLING** 15.00 ft
LOGGED BY AFS **CHECKED BY** SMH
AT END OF DRILLING ---
NOTES Asphalt in vicinity is very broken or absent.
AFTER DRILLING ---

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	FIELD BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ICE BOND	PID (ppm)	OTHER TESTS
0	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 31% gravel, 61% sand, 8% fines Brown, moist, no odor. Gravel subangular to subrounded up to 2 inches. Frost class F-1 (estimated).	HD S1A	92	4-4-3-4 (7)			3.4	LMA
	SM		SILTY SAND, (SM) 11% gravel, 44% sand, 45% fines Brown, moist, no odor. Fine gravel. Frost class F-4 (estimated).	HD S1B					3.6	LMA
	SM		SILTY SAND, (SM) 10% gravel, 50% sand, 40% fines Brown, moist, no odor. Gravel subrounded up to 1 inch. Frost class F-3 (estimated).	HD S2	75	3-2-4-5 (6)			3.3	
5				HD S3A	100	7-6-4-7 (10)			3.2	
	ML		SILT WITH SAND, (ML) 1% gravel, 26% sand, 73% fines Brown transitioning to gray with depth, moist to wet, no odor. Frost class F-4 (estimated).	HD S3B					3.2	LMA
			VS 46.0/16.7 psf	HD S4	75	5-11-12-12 (23)	2.75 2.75 3.0 4.25		2.9	
10			VS 64.8/41.3 psf	HD S5	100	8-7-8-8 (15)			2.6	
15		▽		HD S6A	100	7-5-8-8 (13)			3.3	
	ML		SILT, (ML) 0% gravel, 0% sand, 100% fines Gray, moist, no odor, moderately stiff, low plasticity. VS 150.4/52.2 psf	HD S6B			2.5		3.2	
	SM		SILTY SAND, (SM) 0% gravel, 55% sand, 45% fines Gray, moist to wet, no odor.	HD S6C					3.6	

Bottom of borehole at 17.0 feet.

Notes:
Backfilled with cuttings, pea gravel at surface.

▲ FIELD N VALUE ▲
10 20 30 40
PL MC LL
10 20 30 40

CRW MOA LOG - CRW_DATATEMPLATE_20190115.GDT - 10/19/22 09:59 - 10150.00_TASHA.GPJ

CRW Engineering Group, LLC
3940 Arctic Blvd Ste 300
Anchorage Alaska 99503
Telephone: (907) 562-3252

BOREHOLE BH-05

CLIENT Municipality of Anchorage
PROJECT NAME Tasha Drive Reconstruction
PROJECT NUMBER MOA PM&E Project No. 20-15
PROJECT LOCATION Anchorage, Alaska
DATE STARTED 6/2/21 **COMPLETED** 6/2/21
GROUND ELEVATION
DRILLING CONTRACTOR Discovery Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow-Stem Auger
AT TIME OF DRILLING 11.00 ft
LOGGED BY AFS **CHECKED BY** SMH
AT END OF DRILLING ---
NOTES
AFTER DRILLING 10.00 ft 10/13/2022

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	FIELD BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ICE BOND	PID (ppm)	OTHER TESTS
0			1.5 inches asphalt.							
	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SM) 44% gravel, 49% sand, 7% fines Brown, moist, no odor. Gravel subangular to subrounded up to 3 inches and likely larger, largest gravel in spoon was broken by shoe. Frost class F-2 (estimated).	HD S1	100	10-15-11-10 (26)			3	LMA
	SM		SILTY SAND WITH GRAVEL, (SM) 16% gravel, 48% sand, 36% fines Brown, moist, no odor. Gravel subangular to subrounded up to 1.5 inches. Frost class F-2 (estimated).	HD S2A	75	6-8-6-7 (14)			4	LMA
	ML			HD S2B					4.1	LMA
5			SANDY SILT, (ML) 0% gravel, 33% sand, 67% fines Tan to brown, moist, no odor. Frost class F-4 (estimated).							
	ML		SILT WITH SAND, (ML) 1% gravel, 21% sand, 78% fines Tan, moist, no odor. Frequent orange partings, multiple per inch. Frost class F-4 (hydrometer).	HD S3	92	7-7-8-7 (15)			4.2	MA
				HD S4	100	4-11-12-16 (23)			4.5	
10										
	SP		POORLY GRADED SAND, (SP) 0% gravel, 95% sand, 5% fines	HD S5A					4.5	
	ML		Brown, moist, no odor. Medium sand.	HD S5B	100	11-10-7-6 (17)	2.75		4.4	LMA
			SILT, (ML) 0% gravel, 9% sand, 91% fines Brown, moist, no odor, non-plastic.	HD S5C			2.5		3.2	
	ML		SILT, (ML) 0% gravel, 10% sand, 90% fines Gray, moist to wet, no odor, stiff, low plasticity. VS 75.2/33.4 psf VS 37.6/12.5 psf				>4.5			
15										
	SM		SILTY SAND, (SM) 0% gravel, 50% sand, 50% fines Gray, moist to wet, no odor.	HD S6	92	4-4-7-6 (11)			4	

▲ FIELD N VALUE ▲ 10 20 30 40

PL MC LL 10 20 30 40

Bottom of borehole at 17.0 feet.

Notes:
Completed as standpipe piezometer, 1" Sch40 PVC, hand-slotted screen 6.5-16.5 ft BGS. Backfilled with cuttings. Steel flushmount monument with 1/2" bolts.

Appendix B

Laboratory Results

Included in this section:

1) Laboratory Results from Alaska Testlab

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

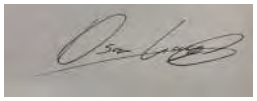
Report No: ASM:21-0989
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-0989-S01	21-0989-S02	21-0989-S03	21-0989-S04	21-0989-S05	21-0989-S06
Client Sample ID	BH-01 S1A	BH-01 S1B	BH-01 S2A	BH-01 S2B	BH-01 S3A	BH-01 S3B
Date Sampled						

Particle Size Distribution

Method:
ASTM D 6913

Description:
Particle size distribution (gradation) of soils using sieve analysis.

Drying by:

Washed:
Sample Washed

Sieve Size	% Passing						Limits
75.0mm	100					100	
50.0mm	100					100	
37.5mm	100					100	
25.0mm	96					100	
19.0mm	91					100	
12.5mm	89					100	
9.5mm	85					100	
4.75mm	75					100	
2.0mm	68					100	
850µm	60					100	
425µm	49					100	
250µm	34					100	
150µm	17					99	
75µm	10					99	
Finer 75µm	9.6					98.4	

Other Test Results

Description	Method	Results						Limits
Water Content (%)	ASTM D 2216	10.6	15.7	12.6	15.1	13.8	24.2	
Method		B	B	B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487	SP-SM	SM		SP-SM		ML	
Group Name		Poorly graded sand with silt and gravel	Silty sand		Poorly graded sand with silt and gravel		Silt	
Method	ASTM D 6913							
Sample Obtained While		Oven-Dried						
Group Name		Poorly graded sand with silt and gravel						
Group Symbol		SP-SM						
Composite Sieving Used		No						
Dispersion Method		Dispersant by hand						
Prior Testing								
Percent Gravel	LMA (Internal Method)		12		26			
Percent Sand			49		63			
Percent Fines (Silt/Clay)			39		11			
Group Symbol			SM		SP-SM			
Dispersion device	ASTM D 422						Dispersant by hand	
Dispersion time (min)								
Shape								
Hardness								

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

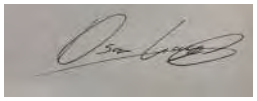
Report No: ASM:21-0989
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-0989-S07	21-0989-S08	21-0989-S09	21-0989-S10	21-0989-S11	21-0989-S12
Client Sample ID	BH-01 S4	BH-01 S5A	BH-01 S5B	BH-01 S6A	BH-01 S6B	BH-01 S6C
Date Sampled						

Other Test Results

Description	Method	Results						Limits
Water Content (%)	ASTM D 2216	23.0	29.0	19.1	20.8	12.7	17.8	
Method		B	B	B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487	ML						
Group Name		Silt						
Percent Gravel	LMA (Internal Method)	0						
Percent Sand		5						
Percent Fines (Silt/Clay)		95						
Group Symbol		ML						

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

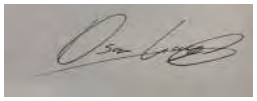
Report No: ASM:21-1000
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1000-S01	21-1000-S02	21-1000-S03	21-1000-S04	21-1000-S05	21-1000-S06
Client Sample ID	BH-02 Sample 1	BH-02 Sample 2	BH-02 Sample 3A	BH-02 Sample 4	BH-02 Sample 5	BH-02 Sample 6
Date Sampled						

Other Test Results

Description	Method	Results						Limits
Water Content (%)	ASTM D 2216	13.6	19.0	15.4	22.9	23.4	21.9	
Method		B	B	B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487	SP-SM		SM				
Group Name		Poorly graded sand with silt and gravel		Silty sand				
Percent Gravel	LMA (Internal Method)	22		10				
Percent Sand		69		63				
Percent Fines (Silt/Clay)		9		27				
Group Symbol		SP-SM		SM				
Approximate maximum grain size	ASTM D 4318							
Material retained on 425µm (No. 40) (%)								
Method of Removal						N/A		
Grooving Tool Type						Plastic		
Specimen preparation method						Dry		
Drying Method						Air		
Special selection process						N/A		
Rolling Method for PL						Hand		
As Received Water Content (%)						23.4		
Liquid Limit Device Type						Mechanical		
Liquid Limit						N/A		
Plastic Limit						NP		
Plasticity Index						NP		
Liquid Limit Procedure						Multipoint (A)		
Tested By						Nathan Lervold		

Comments

NP = Non Plastic

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

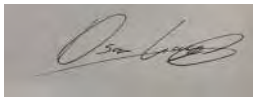
Report No: ASM:21-1001
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1001-S01	21-1001-S02	21-1001-S03	21-1001-S04	21-1001-S05	21-1001-S06
Client Sample ID	BH-03 Sample 1	BH-03 Sample 2A	BH-03 Sample 2B	BH-03 Sample 3A	BH-03 Sample 3B	BH-03 Sample 4
Date Sampled						

Particle Size Distribution

Method:
ASTM D 422

Description:
Analysis of Particle Size Distribution in Soils. Sieving for Particles >75µm, Hydrometer

Drying by:

Washed:
Sample Washed

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	100	
1½in (37.5mm)	100	
1in (25.0mm)	98	
¾in (19.0mm)	98	
½in (12.5mm)	98	
3/8in (9.5mm)	98	
No.4 (4.75mm)	97	
No.10 (2.0mm)	97	
No.20 (850µm)	97	
No.40 (425µm)	97	
No.60 (250µm)	96	
No.100	95	
No.200 (75µm)	83	
Finer No.200	65.1	

Other Test Results

Description	Method	Results						Limits
Water Content (%)	ASTM D 2216	7.6	8.8	26.9	28.3	23.0	24.3	
Method		B	B	B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487		SP-SM	ML		ML		
Group Name			Poorly graded sand with silt and gravel	Silt with sand		Silt with sand		
Percent Gravel	LMA (Internal Method)		35	0				
Percent Sand			57	17				
Percent Fines (Silt/Clay)			8	83				
Group Symbol			SP-SM	ML				
Dispersion device	ASTM D 422					Dispersant by hand		
Dispersion time (min)								
Shape								
Hardness								

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

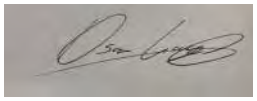
Report No: ASM:21-1001
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1001-S07	21-1001-S08	21-1001-S09	21-1001-S10
Client Sample ID	BH-03 Sample 5A	BH-03 Sample 5B	BH-03 Sample 6A	BH-03 Sample 6B
Date Sampled				

Other Test Results

Description	Method	Results				Limits
Water Content (%)	ASTM D 2216	22.5	23.7	25.6	21.5	
Method		B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487			CL		
Group Name				Lean clay		
Approximate maximum grain size	ASTM D 4318					
Material retained on 425µm (No. 40) (%)						
Method of Removal				N/A		
Grooving Tool Type				Plastic		
Specimen preparation method				Dry		
Drying Method				Air		
Special selection process				N/A		
Rolling Method for PL				Hand		
As Received Water Content (%)				25.6		
Liquid Limit Device Type				Mechanical		
Liquid Limit				28		
Plastic Limit				19		
Plasticity Index				9		
Liquid Limit Procedure				Multipoint (A)		
Tested By				Nathan Lervold		

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

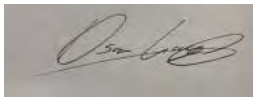
Report No: ASM:21-1002
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1002-S01	21-1002-S02	21-1002-S03	21-1002-S04	21-1002-S05	21-1002-S06
Client Sample ID	BH-04 Sample 1A	BH-04 Sample 1B	BH-04 Sample 2	BH-04 Sample 3A	BH-04 Sample 3B	BH-04 Sample 4
Date Sampled						

Other Test Results

Description	Method	Results						Limits
Water Content (%)	ASTM D 2216	3.5	13.9	10.9	10.3	21.3	23.9	
Method		B	B	B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487	SP-SM	SM			ML		
Group Name		Poorly graded sand with silt and gravel	Silty sand			Silt with sand		
Percent Gravel	LMA (Internal Method)	31	11			1		
Percent Sand		61	44			26		
Percent Fines (Silt/Clay)		8	45			73		
Group Symbol		SP-SM	SM			ML		

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

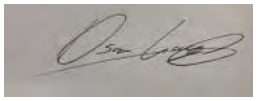
Report No: ASM:21-1002
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1002-S07	21-1002-S08	21-1002-S09	21-1002-S10
Client Sample ID	BH-04 Sample 5	BH-04 Sample 6A	BH-04 Sample 6B	BH-04 Sample 6C
Date Sampled				

Other Test Results

Description	Method	Results				Limits
Water Content (%)	ASTM D 2216	23.9	23.9	26.1	22.1	
Method		B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

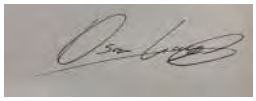
Report No: ASM:21-1003
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1003-S01	21-1003-S02	21-1003-S03	21-1003-S04	21-1003-S05	21-1003-S06
Client Sample ID	BH-05 Sample 1	BH-05 Sample 2A	BH-05 Sample 2B	BH-05 Sample 3	BH-05 Sample 4	BH-05 Sample 5A
Date Sampled						

Particle Size Distribution

Method:
ASTM D 422

Description:
Analysis of Particle Size Distribution in Soils. Sieving for Particles >75µm, Hydrometer

Drying by:

Washed:
Sample Washed

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	100	
1½in (37.5mm)	100	
1in (25.0mm)	100	
¾in (19.0mm)	100	
½in (12.5mm)	100	
3/8in (9.5mm)	100	
No.4 (4.75mm)	99	
No.10 (2.0mm)	99	
No.20 (850µm)	98	
No.40 (425µm)	97	
No.60 (250µm)	92	
No.100	86	
No.200 (75µm)	78	
Finer No.200	75.4	

Other Test Results

Description	Method	Results						Limits
Water Content (%)	ASTM D 2216	3.7	10.0	15.0	16.2	16.3	9.9	
Method		B	B	B	B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487	SP-SM	SM	ML	ML			
Group Name		Poorly graded sand with silt and gravel	Silty sand with gravel	Sandy silt	Silt with sand			
Percent Gravel	LMA (Internal Method)	44	16	0				
Percent Sand		49	48	33				
Percent Fines (Silt/Clay)		7	36	67				
Group Symbol		SP-SM	SM	ML				
Dispersion device	ASTM D 422				Dispersant by hand			
Dispersion time (min)								
Shape								
Hardness								

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

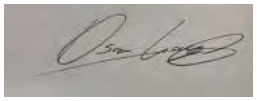
Report No: ASM:21-1003
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

Sample Details

Sample ID	21-1003-S07	21-1003-S08	21-1003-S09
Client Sample ID	BH-05 Sample 5B	BH-05 Sample 5C	BH-05 Sample 6
Date Sampled			

Other Test Results

Description	Method	Results			Limits
Water Content (%)	ASTM D 2216	19.3	22.6	23.5	
Method		B	B	B	
Tested By		Nathan Lervold	Nathan Lervold	Nathan Lervold	
Group Symbol	ASTM D 2487	ML			
Group Name		Silt			
Percent Gravel	LMA (Internal Method)	0			
Percent Sand		9			
Percent Fines (Silt/Clay)		91			
Group Symbol		ML			

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

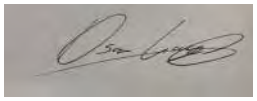
Report No: MAT:21-0989-S01
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

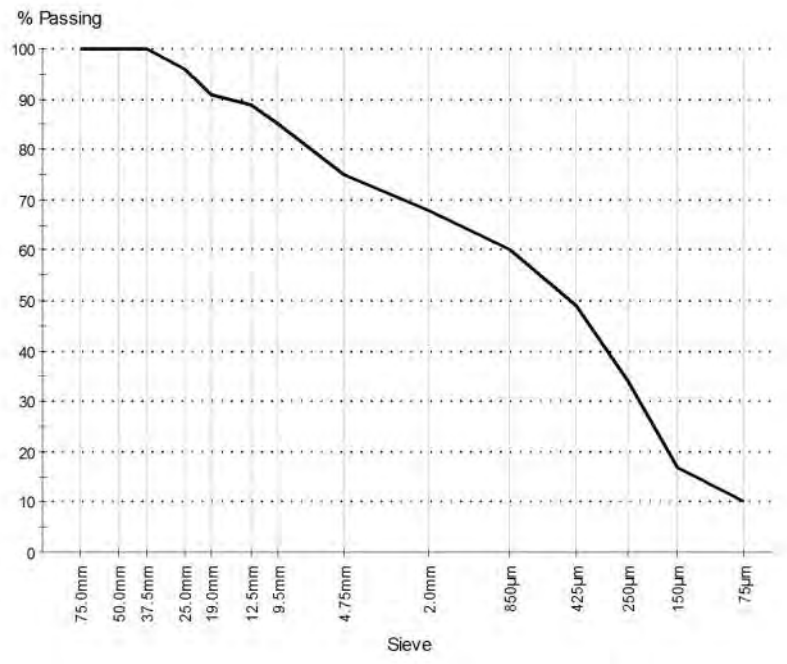
Sample Details

Sample ID	21-0989-S01
Client Sample ID	BH-01 S1A
Specification	Sieve

Other Test Results

Description	Method	Result	Limits
Water Content (%)	ASTM D 2216	10.6	
Method		B	
Tested By		Nathan Lervold	
Date Tested		6/7/2021	
Method	ASTM D 6913		
Sample Obtained While		Oven-Dried	
Group Name	Poorly graded sand with silt and gravel		
Group Symbol		SP-SM	
Composite Sieving Used		No	
Dispersion Method		Dispersant by hand	
Prior Testing			

Particle Size Distribution



Method: ASTM D 6913

Date Tested: 6/8/2021
Tested By: Nathan Lervold

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	100	
1½in (37.5mm)	100	
1in (25.0mm)	96	
¾in (19.0mm)	91	
½in (12.5mm)	89	
3/8in (9.5mm)	85	
No.4 (4.75mm)	75	
No.10 (2.0mm)	68	
No.20 (850µm)	60	
No.40 (425µm)	49	
No.60 (250µm)	34	
No.100 (150µm)	17	
No.200 (75µm)	10	
Finer 75µm	9.6	

Comments

N/A

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

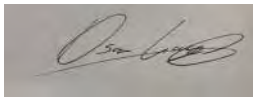
Report No: MAT:21-0989-S06
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

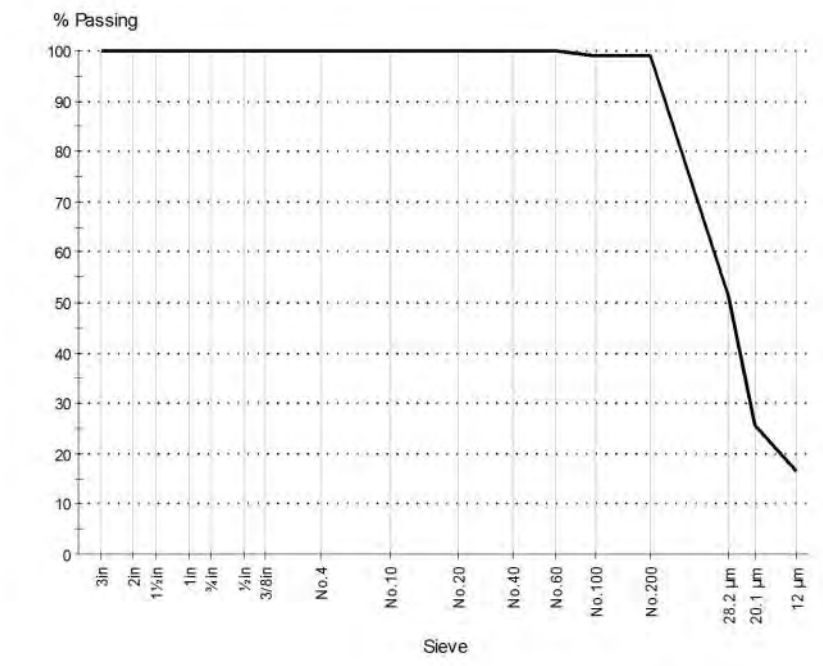
Sample Details

Sample ID	21-0989-S06
Client Sample ID	BH-01 S3B
Specification	Sieve

Other Test Results

Description	Method	Result	Limits
Water Content (%)	ASTM D 2216	24.2	
Method		B	
Tested By		Nathan Lervold	
Date Tested		6/7/2021	
Group Symbol	ASTM D 2487	ML	
Group Name		Silt	
	ASTM D 422		
Dispersion device		Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			

Particle Size Distribution



Method: ASTM D 422

Date Tested: 6/14/2021
Tested By: Cindy Zickefoose

Sieve Size	% Passing	Limits
3in	100	
2in	100	
1½in	100	
1in	100	
¾in	100	
½in	100	
3/8in	100	
No.4	100	
No.10	100	
No.20	100	
No.40	100	
No.60	100	
No.100	99	
No.200	99	
Finer No.200 (75µm)	98.4	
28.2 µm	51.4	
20.1 µm	25.7	
12.0 µm	16.6	

Comments

Frost Class: F4

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

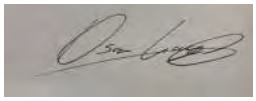
Report No: MAT:21-1001-S05
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

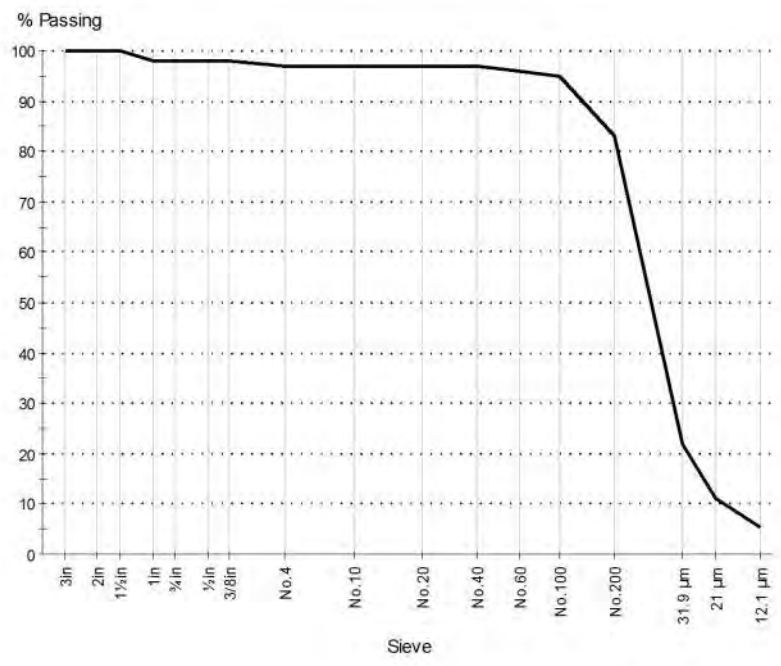
Sample Details

Sample ID	21-1001-S05
Client Sample ID	BH-03 Sample 3B
Specification	Sieve

Other Test Results

Description	Method	Result	Limits
Water Content (%)	ASTM D 2216	23.0	
Method		B	
Tested By		Nathan Lervold	
Date Tested		6/8/2021	
Group Symbol	ASTM D 2487	ML	
Group Name		Silt with sand	
	ASTM D 422		
Dispersion device		Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			

Particle Size Distribution



Method: ASTM D 422

Date Tested: 6/15/2021
Tested By: John Platt

Sieve Size	% Passing	Limits
3in	100	
2in	100	
1½in	100	
1in	98	
¾in	98	
½in	98	
3/8in	98	
No.4	97	
No.10	97	
No.20	97	
No.40	97	
No.60	96	
No.100	95	
No.200	83	
Finer No.200 (75µm)	65.1	
31.9 µm	22.0	
21.0 µm	11.0	
12.1 µm	5.5	

Comments

Frost Class: F4

Alaska Testlab - Anchorage
4040 B Street, Suite 102
Anchorage, AK 99503
Phone: 907-205-1987
Fax: 907-782-4409
info@alaskatestlab.com

Material Test Report

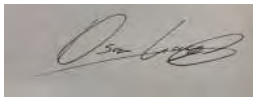
Report No: MAT:21-1003-S04
Issue No: 1

Client: CRW Engineering Group, LLC
3940 Arctic Blvd., Ste. 300
Anchorage, AK, 99503

Project Code: 210186

CC: Ali Sacks
Maria Kampsen
Steven Halcomb

Project: Tasha Drive



Inspected By: Oscar Lage
Title: Laboratory Supervisor
Date: 6/16/2021

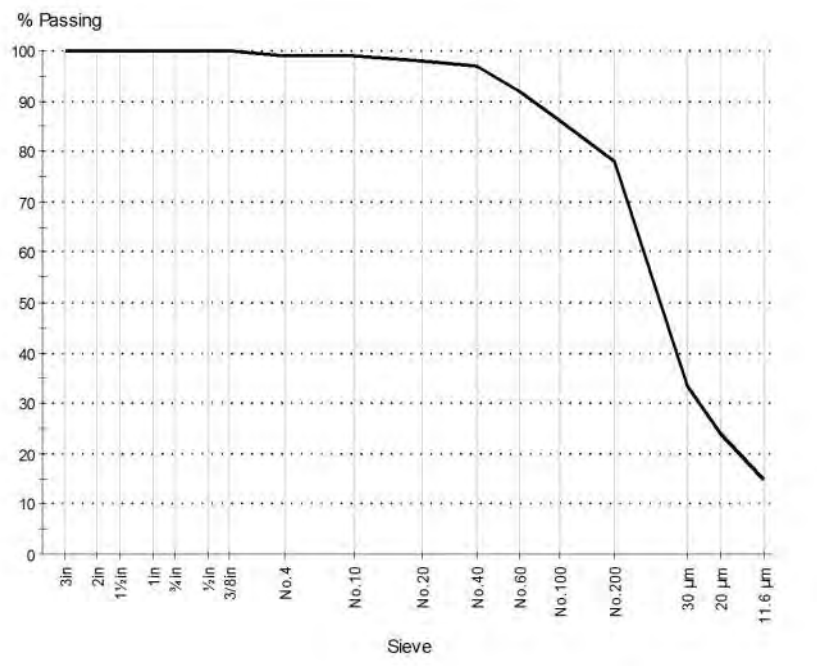
Sample Details

Sample ID	21-1003-S04
Client Sample ID	BH-05 Sample 3
Specification	Sieve

Other Test Results

Description	Method	Result	Limits
Water Content (%)	ASTM D 2216	16.2	
Method		B	
Tested By		Nathan Lervold	
Date Tested		6/8/2021	
Group Symbol	ASTM D 2487	ML	
Group Name		Silt with sand	
	ASTM D 422		
Dispersion device		Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			

Particle Size Distribution



Method: ASTM D 422

Date Tested: 6/15/2021
Tested By: John Platt

Sieve Size	% Passing	Limits
3in	100	
2in	100	
1½in	100	
1in	100	
¾in	100	
½in	100	
3/8in	100	
No.4	99	
No.10	99	
No.20	98	
No.40	97	
No.60	92	
No.100	86	
No.200	78	
Finer No.200 (75µm)	75.4	
30.0 µm	33.5	
20.0 µm	24.1	
11.6 µm	14.7	

Comments

Frost Class: F4

Appendix C

Site Investigation Photos

Included in this section:

1) Select Site Photos

Tasha Drive Reconstruction:
Geotechnical Investigation — Site Investigation Photos

05/26/2021: BH-01 with utility markings (left). Borehole marked with white paint.
06/02/2021: Drill rig set up on BH-01 (right).

06/02/2021: BH-01 and BH-01 redrill (second attempt at 15-foot sample) after completion. BH-01 (left) backfilled with cuttings and cold patched. BH-01 redrill (right) completed as piezometer with flush mount steel monument.

Tasha Drive Reconstruction:
Geotechnical Investigation — Site Investigation Photos

05/27/2021: BH-02 with utility markings (left). Borehole marked with white paint.
06/02/2021: Drill rig set up on BH-02 (right).

06/02/2021: BH-02 after completion, backfilled with cuttings and cold patched.

Tasha Drive Reconstruction:
Geotechnical Investigation — Site Investigation Photos

05/27/2021: BH-03 with utility markings prior to drilling and assessment of location by private locator. Borehole marked with white paint.

06/02/2021: After consulting with a private locator, BH-03 was moved to the west and toward the road centerline to avoid utility conflicts (left). Drill rig set up on BH-03 final location (right).

Tasha Drive Reconstruction:
Geotechnical Investigation — Site Investigation Photos

06/02/2021: BH-03 completed as a piezometer with flush mount steel monument.

06/02/2021: BH-04 before drilling with utility markings (left) and after completion (right), backfilled with cuttings and gravel spread at surface. Two locations were cleared for BH-04, and the easternmost location was drilled because the pavement showed the most distress.

Tasha Drive Reconstruction:
Geotechnical Investigation — Site Investigation Photos

06/02/2021: BH-05 with utility markings prior to drilling. Borehole marked with white paint.

06/02/2021: BH-05 after completion as piezometer with flush mount steel monument.

Appendix D

Historic Geotechnical Data

Included in this section:

1) MOA Construction Division

MOA Construction Division

MUNICIPALITY OF ANCHORAGE

DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION DIVISION

(12)

SOILS LOG

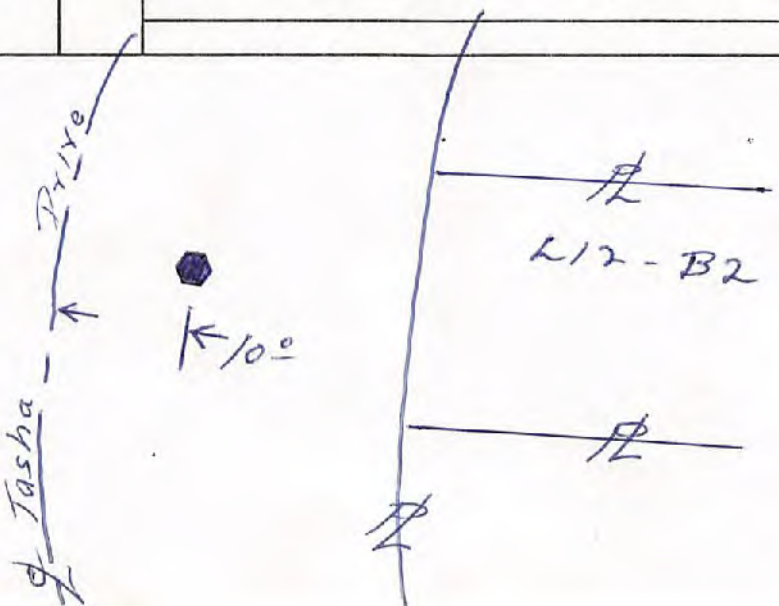
LOCATION L12-B2 Cambrian Park
Tasha Drive

COMMENTS Visual Only

HOLE NO. _____
DATE 8-7-81
BY J. Swolkien
DEPTH 9'
WATER TABLE 5'

	DEPTH	UNIFIED CLASS	FROST GROUP	DESCRIPTION
	0			Road Surface
	1			
	2			
	3	SM		Silty Sand, All Depths
	4			
▼	5			Water Table
	6			
	7			
	8			
●	9			8" A.C. Sewer Main & B.O.H.
	10			
	11			
	12			
	13			
	14			

LOCATION SKETCH:



LEGEND

SYMBOL

- TEST HOLE
- WATER TABLE
- FROZEN MATERIAL (2, 3, 4, 5)

ALL FROST CLASSIFICATION BASED ON THE .02mm = 50% OF THE -#200 UNLESS OTHERWISE NOTED

GRID NO. 2327 B

Appendix E

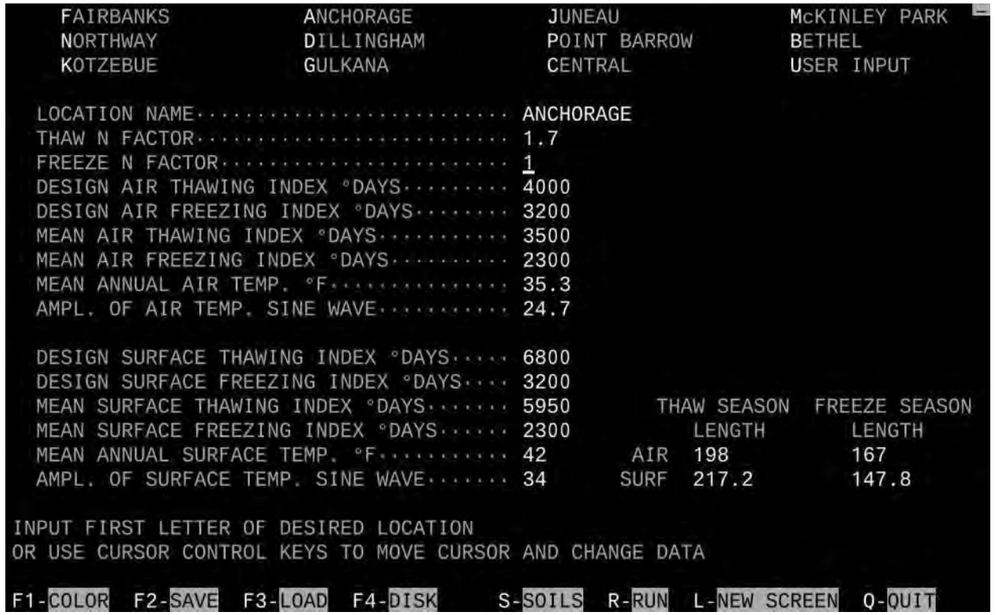
BERG2 Thermal Analysis Output

Included in this section:

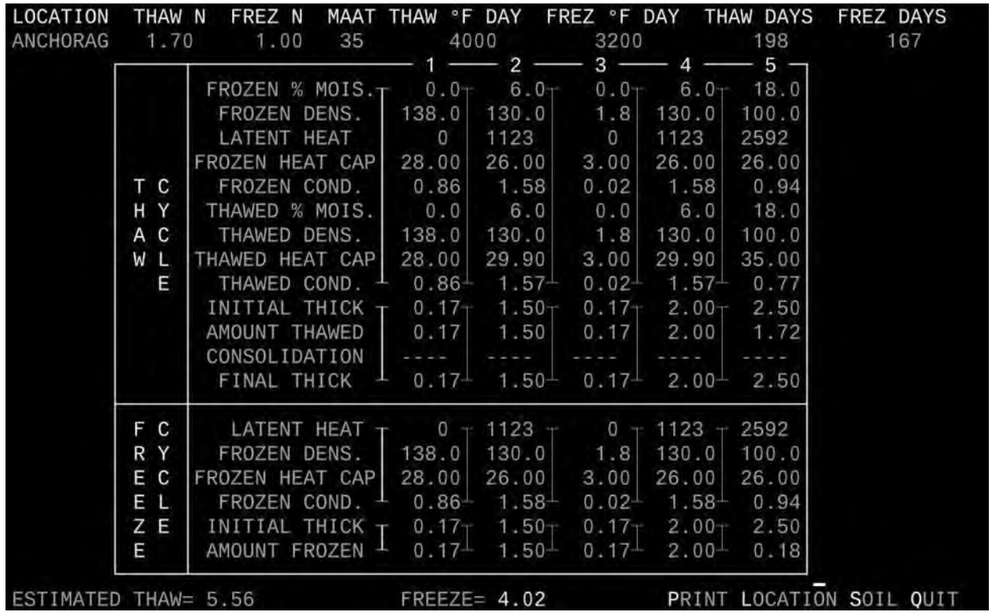
1) BERG2 Analysis – Limited Subgrade Frost Penetration Analysis – 2" Insulated Section

BERG2 Analysis – Limited Subgrade Frost Penetration Analysis – 2” Insulated Section

LOCATION/CLIMATE:



ANALYSIS RESULTS:



SOIL INPUTS

Layer	Thickness (ft)	Density (pcf)	M.C. (%)	Comment
Asphalt	0.17	138	-	-
Fill (Type II-A)	1.50	130	6.0	-
Insulation	0.17	1.8	-	-
Fill (Type II)	2.00	130	6.0	-
Subgrade	2.50	100	18.0	-

RESULTS

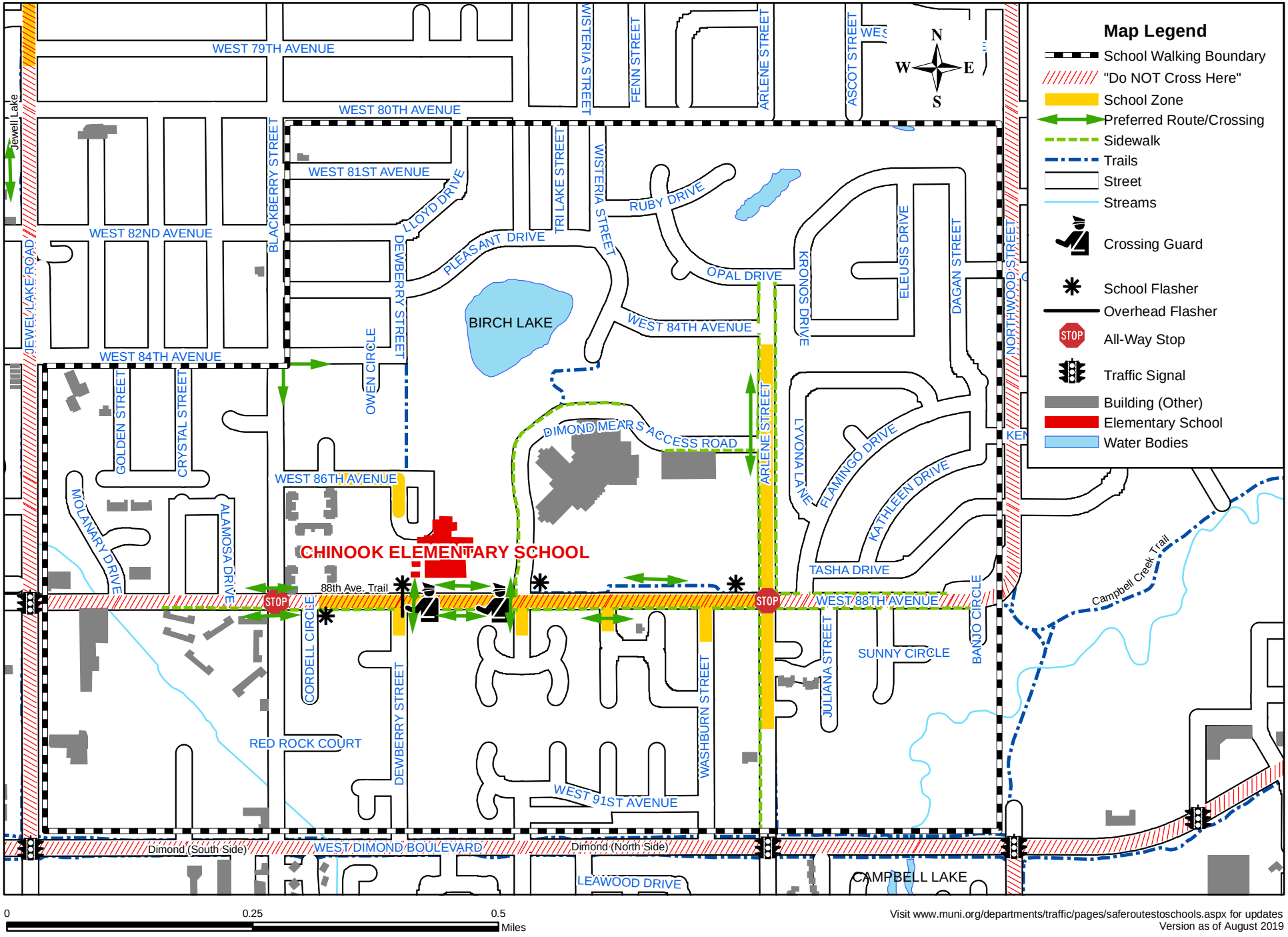
Parameter	Value
Total Section Thickness	3.83 ft
Thaw Depth	5.59 ft
Freeze Depth	4.02 ft
Subgrade Frost Penetration	0.18 ft
Subgrade Frost Percent[1]	4.7%

1. Equal to Subgrade Frost Penetration divided by Total Section Thickness

Traffic Data, Reports, and Studies

Appendix F

Chinook Elementary



0 0.25 0.5 Miles

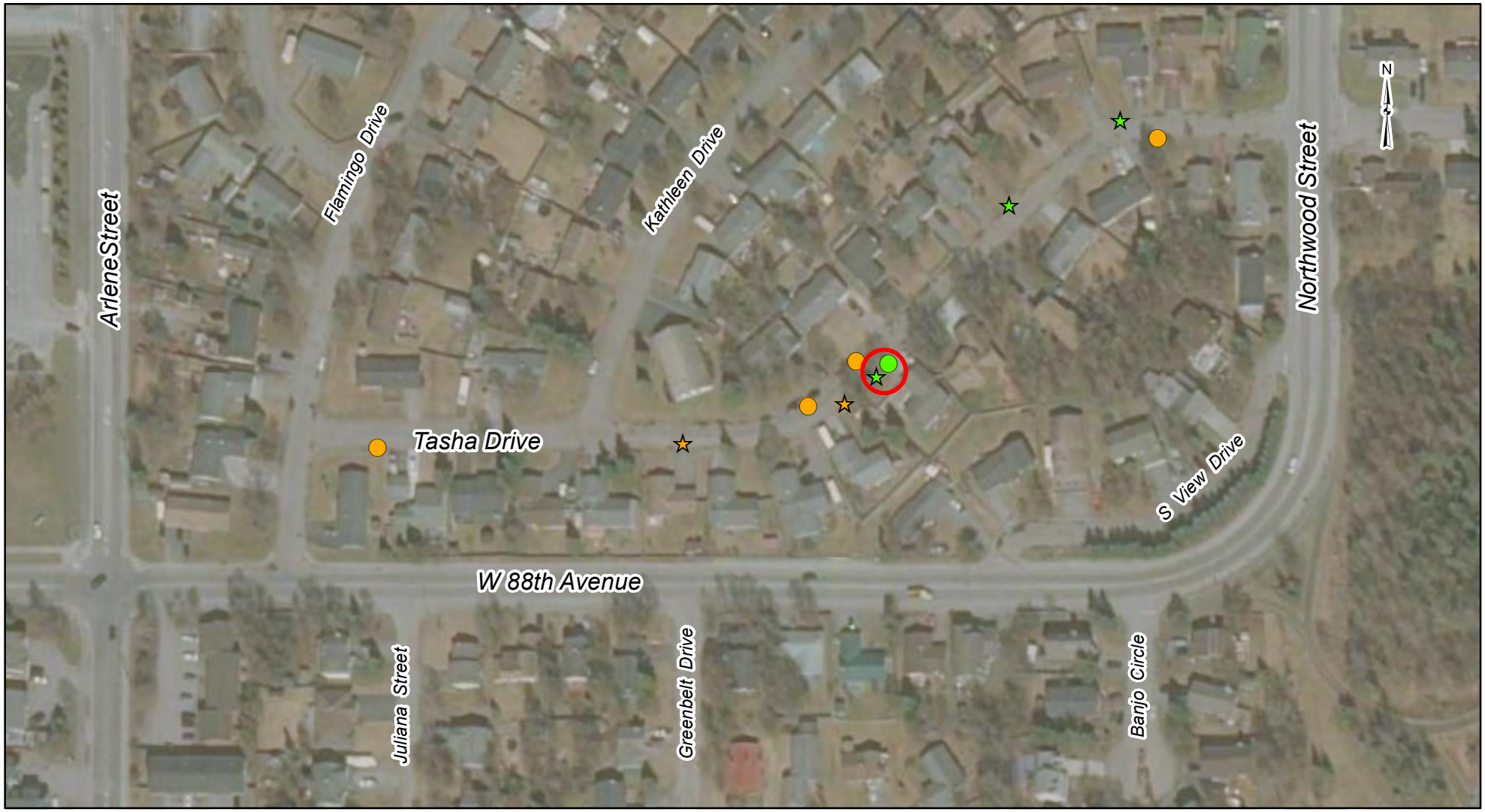
Visit www.muni.org/departments/traffic/pages/saferoutestoschools.aspx for updates
Version as of August 2019

Tasha Drive Parking Study

Legend

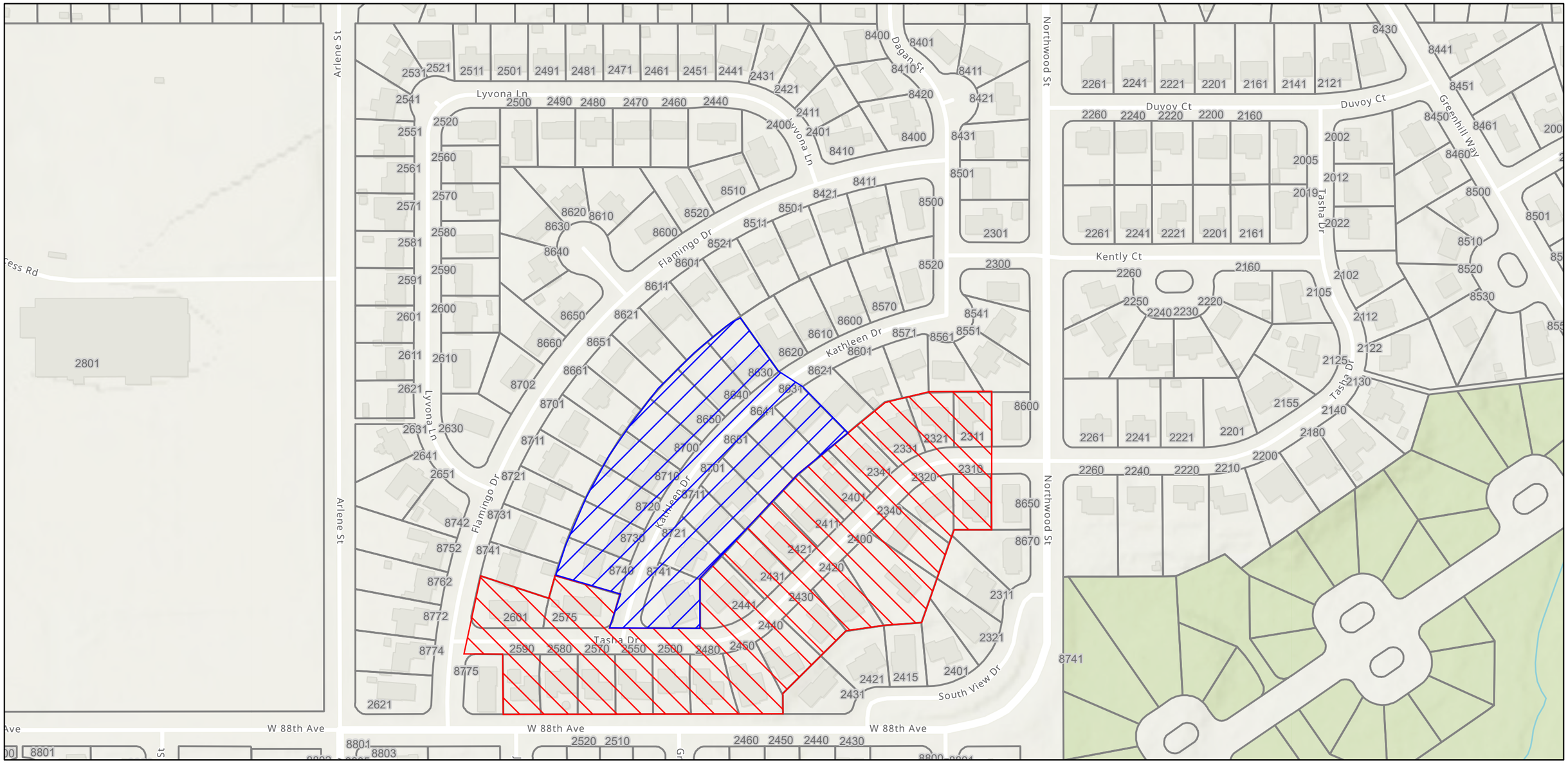
- Saturday Evening
- Saturday at Noon
- Wednesday Evening
- Wednesday at Noon
- Unmoved Vehicle

Tasha Drive (from Flamingo Drive to Northwood Street)



540 270 0 540 Feet

TASHA DRIVE TRIP GENERATION



11/29/2022, 3:33:13 PM

Property Information

Addresses_Hosted

Trip Generation Based on ITE Trip Generation Manual, 11th Ed. Section 210

	No.	Avg. Trips	% on Tasha	Trips on Tasha
Residences with Direct Access to Tasha	25	290	100%	290
Residences with Indirect Access to Tasha	15	183	50%	92

1:4,514

0 0.03 0.05 0.1 mi

0 0.04 0.07 0.15 km

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Kenai Peninsula Borough, Matanuska-Susitna Borough GIS, Municipality

MOA GIS

Easement Spreadsheets

Appendix G

ROW REQUIREMENTS ESTIMATE - DSM

Tasha Drive Storm Drainage Project : ROW Summary

PARCEL	PUE	SE	TCE	Drainage Easement	# Of TCP's
1					
2		X			X
4					
5					X
6					X
7					X
8					X
9					X
10					X
11					X
12					X
13					X
14					
15					X
16					X
17					X
18					X
19					X
20					X
21					X
22					X
23					X
24					X
25					X
26					X
27					X
28					X
29					X
30					X
TOTAL	0	1	0	0	26

Project Cost Estimates

Appendix H

Tasha Drive Reconstruction
MOA Project No. 20-15

ENGINEER'S ESTIMATE - 35% DESIGN

ITEM No.	MASS No.	ITEM DESCRIPTION	UNIT	CALC. QUANT	CONT. FACTOR	ROUND FACTOR	EST QUANT	UNIT PRICE	TOTAL COST
Schedule A - Roadway Improvements									
A-1	20.02	Storm Water Pollution Prevention Plan	LS	1	1.00	0	1	$18,000	$18,000
A-2	20.03	Test Pit for Utility Locate	Hour	8	1.00	0	8	$800	$6,400
A-3	20.04	Clearing and Grubbing	LS	1	1.00	0	1	$16,000	$16,000
A-4	20.06	Tree Removal	EA	4	1.00	0	4	$1,000	$4,000
A-5	20.07	Remove Sidewalk or Concrete Apron	SY	21	1.00	0	21	$30	$630
A-6	20.08	Remove Curb and Gutter	LF	2,440	1.00	0	2,440	$12	$29,280
A-7	20.09	Remove Pavement	SY	4,906	1.00	0	4,906	$7	$34,342
A-8	20.10	Unusable Excavation	CY	6,882	1.20	-2	8,300	$15	$124,500
A-9	20.12	Dewatering	LS	1	1.00	0	1	$11,000	$11,000
A-10	20.21	Classified Fill and Backfill (Type II)	Ton	6,480	1.20	-2	7,800	$19	$148,200
A-11	20.21	Classified Fill and Backfill (Type II-A)	Ton	5,827	1.20	-2	7,000	$20	$140,000
A-12	20.22	Leveling Course	Ton	433	1.06	-1	460	$47	$21,620
A-13	20.25	Geotextile (Type A)	SY	6,460	1.00	-1	6,460	$3	$19,380
A-14	20.26	Insulation Board (R-9)	SF	48,949	1.01	-1	49,440	$3	$148,320
A-15	20.26	Insulation Board (R-4.5)	SF	2,896	1.01	-1	2,930	$2	$5,860
A-16	20.28	Existing Driveway Reconstruction, Concrete	EA	11	1.00	0	11	$750	$8,250
A-17	20.28	Existing Driveway Reconstruction, Asphalt	EA	13	1.00	0	13	$1,500	$19,500
A-18	30.02	P.C.C. Curb and Gutter (All Types)	LF	2,438	1.00	0	2,438	$40	$97,520
A-19	30.03	P.C.C. Sidewalk (6" Thick, Standard Finish)	SY	30	1.00	0	30	$116	$3,480
A-20	30.04	P.C.C. Curb Ramp (6" Thick)	EA	2	1.00	0	2	$4,510	$9,020
A-21	30.04	Detectable Warnings	SF	20	1.00	0	20	$110	$2,200
A-22	40.06	A.C. Pavement (Class E)	Ton	915	1.06	-1	970	$150	$145,500
A-23	50.06	Remove and Replace Manhole Cover and Frame	EA	4	1.00	0	4	$1,550	$6,200
A-24	50.09	Adjust Cleanout to Finish Grade	EA	1	1.00	0	1	$1,200	$1,200
A-25	60.03	Remove and Replace Valve Box Top Section	EA	5	1.00	0	5	$800	$4,000
A-26	65.02	Construction Survey Measurement	LS	1	1.00	0	1	$30,000	$30,000
A-27	65.02	Two-Person Survey Crew	Hour	40	1.00	0	40	$250	$10,000
A-28	70.08	Remove and Reset Fence	LF	134	1.05	0	141	$60	$8,460
A-29	70.08	Remove Fence	LF	54	1.00	0	54	$14	$756
A-30	70.10	Inlaid Traffic Markings (Methyl Methacrylate, 24" White, 125	LF	15	1.00	0	15	$30	$450
A-31	70.11	Standard Sign	SF	40	1.00	0	40	$100	$4,000
A-32	70.12	Traffic Maintenance	LS	1	1.00	0	1	$100,000	$100,000
A-33	70.16	Temporary Group Mailboxes	LS	1	1.00	0	1	$5,000	$5,000
A-34	70.17	Relocate Mailbox	EA	28	1.00	0	28	$650	$18,200
A-35	70.22	Removal/Disposal and/or Salvage/Installation of Obstructions	LS	1	1.00	0	1	$20,000	$20,000
A-36	70.23	Temporary Fencing	LF	134	1.05	0	141	$20	$2,820
A-37	75.03	Topsoil (4-inch Depth)	MSF	10.3	1.20	0	12	$750	$9,000
A-38	75.04	Seeding (Schedule A)	MSF	10.3	1.20	0	12	$500	$6,000
A-39	75.12	Temporary Tree Protection Fence	LF	50	1.00	0	50	$18	$900
A-40	75.13	Root Pruning	LF	50	1.00	0	50	$20	$1,000
								TOTAL	**$1,240,988**

Tasha Drive Reconstruction
MOA Project No. 20-15

ENGINEER'S ESTIMATE - 35% DESIGN

ITEM No.	MASS No.	ITEM DESCRIPTION	UNIT	CALC. QUANT	CONT. FACTOR	ROUND FACTOR	EST QUANT	UNIT PRICE	TOTAL COST
Schedule B - Drainage Improvements									
B-1	20.13	Trench Dewatering	LS	1	1.00	0	1	$30,000	$30,000
B-2	20.13	Trench Excavation and Backfill (Various Depths)	LF	1,364	1.00	0	1,364	$40	$54,560
B-3	20.15	Furnish Trench Backfill (Type II)	Ton	220	1.20	0	264	$18	$4,752
B-4	20.26	Insulation Board (R-20)	SF	160	1.20	0	192	$5	$960
B-5	20.27	Disposal of Unusable or Surplus Material	CY	460	1.20	0	552	$22	$12,144
B-6	50.04	Relocate Sewer Service (4-Inch)	EA	2	1.20	0	2	$6,000	$12,000
B-7	55.03	Furnish, Install, and Televise Subdrain with Geotextile (12-Inch	LF	155	1.00	0	155	$85	$13,175
B-8	55.03	Furnish, Install, and Televise Subdrain with Geotextile (18-Inch	LF	1,209	1.00	0	1,209	$95	$114,855
B-9	55.04	Connect to Existing Storm Drain System	EA	1	1.00	0	1	$3,000	$3,000
B-10	55.05	Construct (Type I) Manhole	EA	8	1.00	0	8	$7,000	$56,000
B-11	55.09	Construct Catch Basin	EA	8	1.00	0	8	$5,500	$44,000
B-12	55.11	Remove Manhole	EA	1	1.00	0	1	$1,500	$1,500
B-13	55.11	Remove Catch Basin	EA	1	1.00	0	1	$1,200	$1,200
B-14	55.18	Construct Footing Drain Service with Geotextile (6-inch, Type S	EA	29	1.00	0	29	$2,000	$58,000
B-15	55.27	Storm Drain Bypass System	LS	1	1.00	0	1	$10,000	$10,000
B-16	70.07	Remove Pipe	LF	83	1.00	0	83	$20	$1,660
								TOTAL	**$417,806**
Schedule C - Illumination Improvements									
C-1	80.01	Temporary Illumination	LS	1	1.00	0	1	$7,500	$7,500
C-2	80.02	Trench and Backfill (2'W x 3.5'D)	LF	1,150	1.10	-1	1,270	$17	$21,590
C-3	80.04	Driven Pile Luminaire Pole Foundations	EA	9	1.00	0	9	$4,500	$40,500
C-4	80.04	Load Center Foundation (Type 1A)	EA	1	1.00	0	1	$4,000	$4,000
C-5	80.05	Fixed Base Luminaire Pole (27-28 Ft. Length)	EA	9	1.00	0	9	$3,800	$34,200
C-6	80.05	Spare Fixed Base Luminaire Pole (28 Ft. Length)	EA	2	1.00	0	2	$2,250	$4,500
C-7	80.05	Luminaire Arm (9-13 Ft. Length)	EA	11	1.00	0	11	$700	$7,700
C-8	80.07	GRC Steel Conduit (2 inch)	FT	1,320	1.05	-1	1,390	$27	$37,530
C-9	80.08	Junction Box (Type IA)	EA	10	1.00	0	10	$1,400	$14,000
C-10	80.08	Junction Box (Type II)	EA	1	1.00	0	1	$2,250	$2,250
C-11	80.10	3 Conductor 8 AWG Type XHHW-2 Cable	FT	1,200	1.05	-1	1,260	$8	$10,080
C-12	80.14	Single-Meter Pad-Mount Load Center, Type 1A, with Lighting C	EA	1	1.00	0	1	$7,000	$7,000
C-13	80.23	Luminaire (4,000 Lm, Medium Type 2)	EA	9	1.00	0	9	$510	$4,590
C-14	80.23	Luminaire (6,000 Lm, Medium Type 2)	EA	2	1.00	0	2	$613	$1,225
C-15	80.23	Spare Luminaire (4,000 Lm, Medium Type 2)	EA	2	1.00	0	2	$413	$825
C-16	80.23	Spare Luminaire (6,000 Lm, Medium Type 2)	EA	2	1.00	0	2	$527	$1,054
								TOTAL	**$198,544**

SUMMARY	
Schedule A - Roadway Improvements	$1,240,988
Schedule B - Drainage Improvements	$417,806
Schedule C - Illumination Improvements	$198,544
Subtotal	$1,857,338
15% Construction Contingency	$278,601
Total Estimated Construction Cost:	**$2,135,939**

Tasha Drive Reconstruction
Flamingo Drive to Northwood Street
Utility Relocation Estimate

Utility Relocation Summary Tasha Drive Reconstruction	
Electric	$5,000
Telephone (ACS)	$0
Cable Television (GCI)	$0
Natural Gas (Enstar)	$248,000
Subtotal:	*$253,000*
Construction Contingency (15%)	*$38,000*
Total Utility Relocation Cost:	**$291,000**

Tasha Drive Reconstruction
Flamingo Drive to Northwood Street
CEA Utility Relocation Summary

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST	COMMENTS
CEA-1	3+55	RT	Existing Light Pole and overhead service	To be Abandoned	Abandon	1	EA	$2,000	$2,000	
CEA-2	9+45	LT	Existing Light Pole and underground service	To be Abandoned	Abandon	1	EA	$2,000	$2,000	
CEA-3	12+42	CL	Underground Electric crossing	Within Roadway Structural Section	Protect in place	50	LF	$0	$0	

Construction Costs:	$4,000
Engineering/Administration (30%):	$1,200
Total:	**$5,000**

Tasha Drive Reconstruction
Flamingo Drive to Northwood Street
ACS Utility Relocation Summary

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST	COMMENTS
ACS-1	12+40	CL	underground crossing	Within Roadway Structural Section	Protect in Place	50	LF	$0	$0	

Construction Costs:	$0
Engineering/Administration (30%):	$0
Total:	**$0**

Tasha Drive Reconstruction
Flamingo Drive to Northwood Street
GCI Utility Relocation Summary

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST	COMMENTS
GCI-1	12+52	CL	underground coaxial crossing	Within Roadway Structural Section	Protect in place	50	LF	$0	$0	

Construction Costs:	$0
Engineering/Administration (30%)	$0
Total:	**$0**

Tasha Drive Reconstruction
Flamingo Drive to Northwood Street
ENSTAR Utility Relocation Summary

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	Lengths Used for Rounding	AMOUNT	UNIT	UNIT PRICE	COST	COMMENTS
Enstar-1	0+50 to 12+35	RT	Underground 2-inch steel	Within Roadway Structural Section	Relocate	1200	1200	LF	$120	$144,000	Assume replace with plastic
Enstar-2	2+10	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-3	3+42	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$100	$5,000	Assume replace with plastic
Enstar-4	5+15	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-5	7+35	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-6	8+75	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-7	10+15	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-8	11+10	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-9	11+90	CL	underground 3/4 inch steel	Within Roadway Structural Section	Relcoate	50	50	LF	$85	$4,250	Assume replace with plastic
Enstar-10	12+35	CL	underground 1-1/4-inch steel	Within Roadway Structural Section	Relocate as needed	100	100	LF	$120	$12,000	Assume replace with plastic

Construction Costs:	$190,750
Engineering/Administration (30%)	$57,225
Total:	**$248,000**

Public Involvement

Appendix I

The Municipality of Anchorage Project Management & Engineering Department (MOA PM&E) is planning to reconstruct Tasha Drive (from Flamingo Drive to Northwood Street) to meet current MOA design criteria for a local roadway.

Improvements may include:

- New road foundation
- New asphalt pavement
- New curb & gutter
- Continuous storm drain system
- Improved street lighting
- New sidewalks (if warranted)

The MOA has contracted with CRW Engineering Group, LLC (CRW) to provide preliminary engineering and design services. The project is funded through the Design Study Report (DSR) phase using local road bonds. Additional funding will be necessary for design and pre-construction tasks. The earliest construction could occur is in 2022 if funding becomes available.

How to get involved:

- Visit the project website for meeting schedules, project documents, and to sign up for e-mail updates.
- Complete the project questionnaire, which will be mailed later this month with instructions for submitting your responses by mail or online.
- Attend a public open house. Check the project website for more information.

For more information and to sign up for e-mail updates, please visit the web page or contact:

Holly Spoth-Torres,
Public Involvement

(907) 223-0136 • comments@crweng.com

www.TashaDriveReconstruction.com

CRW ENGINEERING GROUP, LLC
3940 Arctic Blvd. Suite 300
Anchorage, Alaska 99503

Tasha Drive Reconstruction, Project Map

MUNICIPALITY OF ANCHORAGE
PM&E

www.TashaDriveReconstruction.com

Questionnaire Results

Date: June 2, 2021
Prepared by: Michelle Fehribach, Huddle AK
Project: Tasha Drive Reconstruction
Project No.: 20-15

Summary

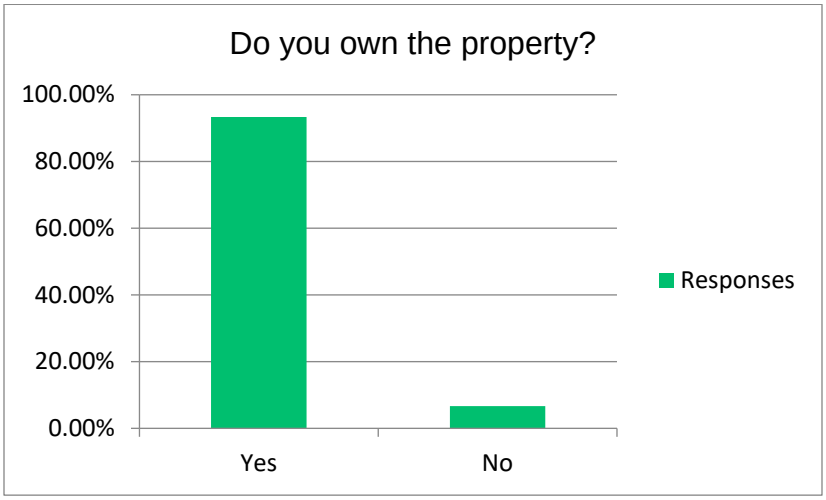
A questionnaire was created by the project team to gather specific input from residents about the project area. The questionnaire was deployed using two methods:

1. A newsletter mailer with a hard copy questionnaire that could be returned using the pre-paid postage was mailed to approximately 48 addresses, including both the occupant of the property and the owner of the property (if different than the project area). Please see page 10 for a map of the questionnaire mailing area.
2. Alternatively, the questionnaire could be filled out online using Survey Monkey. The link to the questionnaire was provided on the newsletter mailer using a QR code and a link to the questionnaire was provided on the project website.

The questionnaire was open for responses from May 7 – 28, 2021. A total of 15 people completed the questionnaire. Below is a summary of the answers to each question, including the open-ended responses.

Question: Do you own the property?

Answered: 15 Skipped: 0
Yes: 14 (93%) No: 1 (7%)

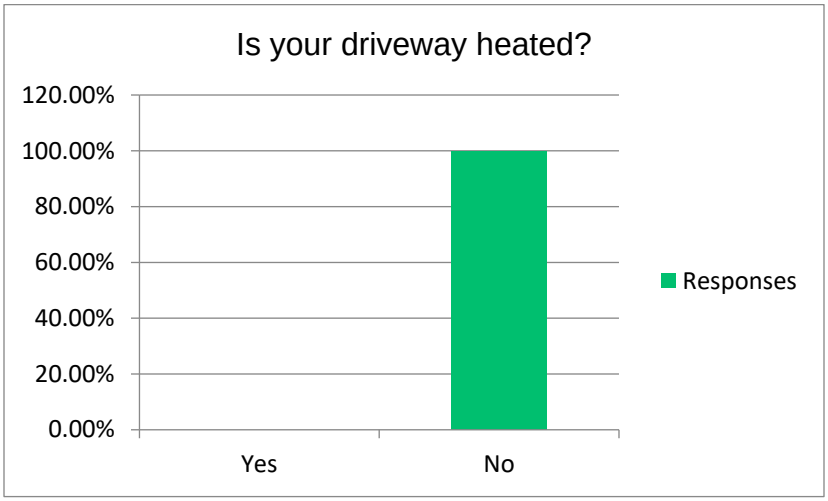


One person who completed the questionnaire does not own the property they are living in:

Name	Address
David Barron	2430 Tasha Dr

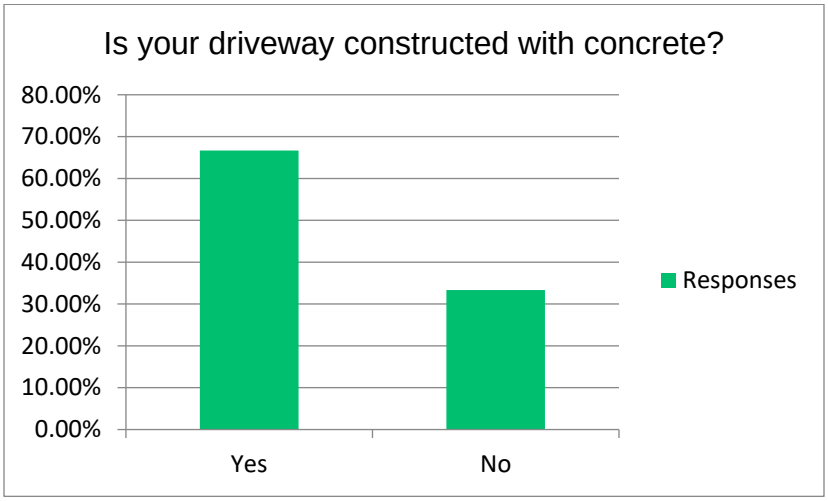
Question: Is your driveway heated?

Answered: 15 Skipped: 0
Yes: 0 (0%) No: 15 (100%)



Question: Is your driveway constructed with concrete?

Answered: 15 Skipped: 0
Yes: 10 (67%) No: 5 (33%)



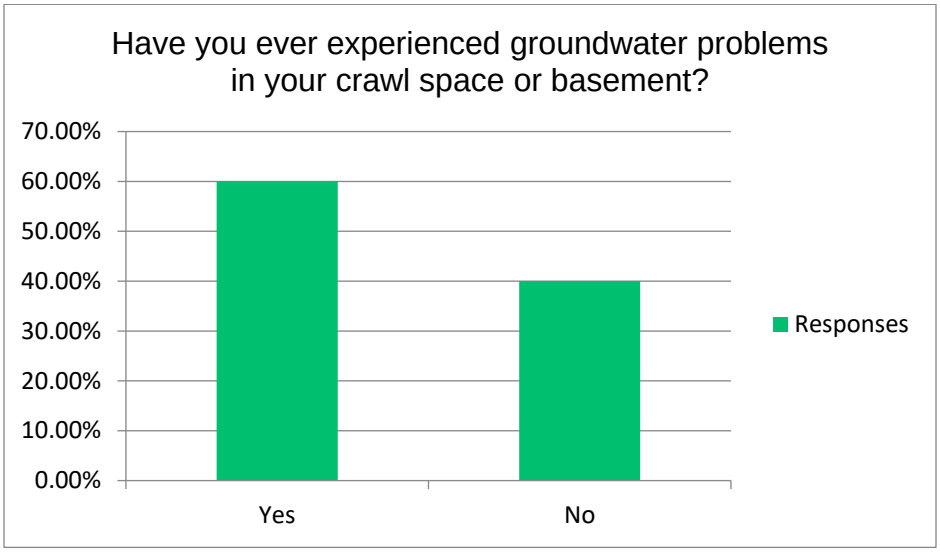
The people who responded "yes" are listed below:

Name	Address
Dave Barron	2430 Tasha Dr
Eugene Ragle	2480 Tasha Dr
Hans Bohlman	2431 Tasha Dr
Torrine McCarty	2450 Tasha Dr
Waters Trust	2440 Tasha Dr
Anna and Richard Crocker	2341 Tasha Dr
Anneliese Tschannen	2575 Tasha Dr

Gerald Henningsen	2601 Tasha Dr
Wayne Curley and Linda Rustigan	2590 Tasha Dr
Dave and Carolyn Cechowski	2340 Tasha Dr

Question: Have you ever experienced groundwater problems in your crawl space or basement?

Answered: 15 Skipped: 0
Yes: 9 (60%) No: 6 (40%)



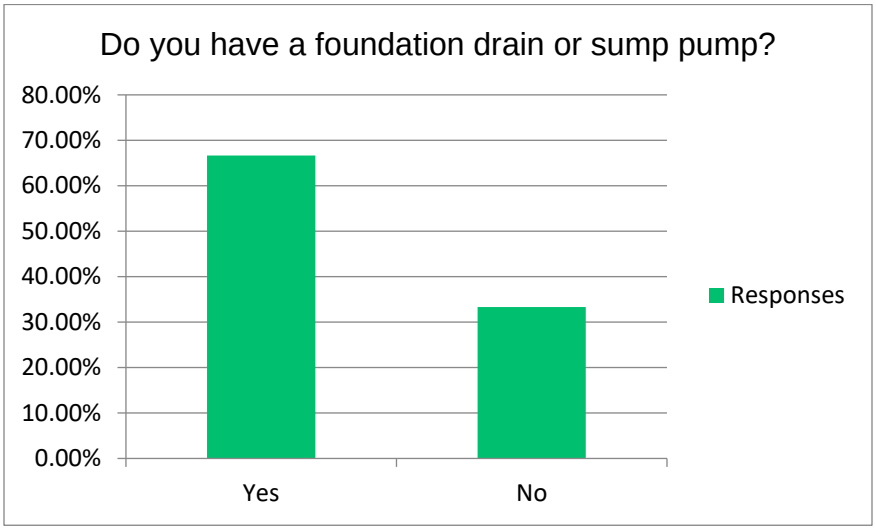
While nine people said "yes", eight people wrote an answer to explain where the groundwater occurs. Those responses are below:

If yes, please explain:	Name	Address
When snow melts in spring, water accumulates in crawl space. Also after many days of rain (heavy rain).	Dave and Carolyn Cechowski	2340 Tasha Dr
Water in crawl space	Wayne Curley and Linda Rustigan	2590 Tasha Dr
Heavy rains/snow melting in spring	Mike Click	8775 Flamingo Dr
Some water pools so we have 2 sump pumps	Anna and Richard Crocker	2341 Tasha Dr
No comment	Waters Trust	2440 Tasha Dr
We require 4 sump pumps due to all the water AND how the muni plows all the snow onto my property.	Torrine McCarty	2450 Tasha Dr
Every spring melt water was in crawl space when freeze level thawed. I built a retaining wall to stop this problem.	Hans Bohlman	2431 Tasha Dr
Backyard	Eugene Ragle	2480 Tasha Dr
Previous owner only had two downspout locations both against house so had some	Gary Haynes	2580 Tasha Drive

water after rains. I separated and extended spouts and seems to have cured the problem. I do not have a French drain around the house		

Question: Do you have a foundation drain or sump pump?

Answered: 15 Skipped: 0
Yes: 10 (67%) No: 5 (33%)



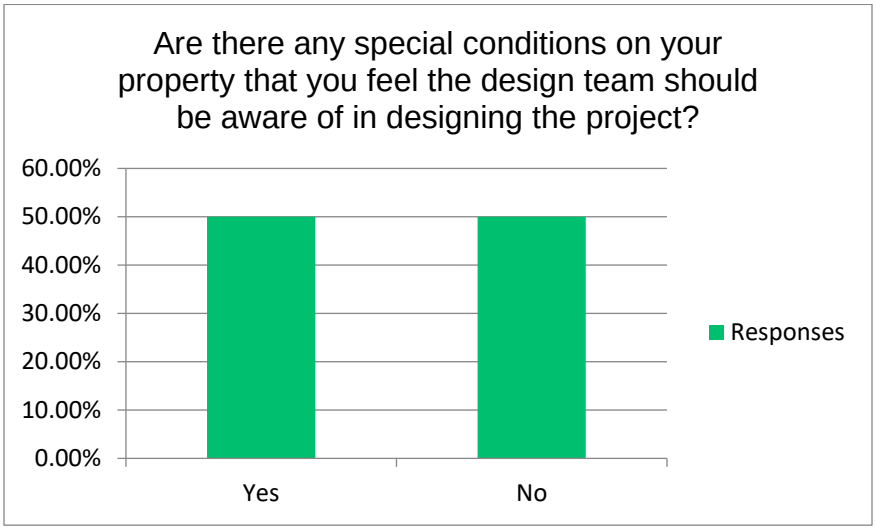
The individual responses for the 10 people who answered "yes" are listed below:

#	Location	Where it drains	How often it runs	Name	Address
1	In crawl space	Front of house	Spring from snow melt, if we have many days of rain	Dave and Carolyn Cechowski	2340 Tasha Dr
2	in crawl space	outside	spring	Gretchen Cornelius	2570 Tasha Dr
sump pump - 1	crawl space	east side of house	spring, fall, after snowmelt, after heavy rains	Wayne Curley and Linda Rustigan	2590 Tasha Dr
1	NW corner of house	NW corner of house	never	Mike Click	8775 Flamingo Dr
1	SW corner	to the front yard	never	Gerald Henningsen	2601 Tasha Dr
1	Crawl space	to the east side of house	have never heard it run	Anneliese Tschannen	2575 Tasha Dr
2	crawl space	into our front yard	after storms	Anna and Richard Crocker	2341 Tasha Dr

2	crawl space	*skipped*	spring, storms	Waters Trust	2440 Tasha Dr
4	under the house	outside	spring, fall, after storms	Torrine McCarty	2450 Tasha Dr
1	crawlspace	yard	After storms or snowmelt	Eugene Ragle	2480 Tasha Dr

Question: Are there any special conditions on your property that you feel the design team should be aware of in designing the project?

Answered: 14 Skipped: 1
Yes: 7 (50%) No: 7 (50%)



While seven people responded "yes", eight people wrote responses to this question, which are below:

Preservation of Vegetation/Trees	Name	Address
I have a two-trunk tree that I believe is in the road right of way and understand that it may have to go depending on new design. I have one more in the front on the property so would that one would remain.	Gary Haynes	2580 Tasha Drive
Heave & Drainage		
water in the crawl space	Wayne Curley and Linda Rustigan	2590 Tasha Dr
Please fix the slope from street and the retaining wall	Torrine McCarty	2450 Tasha Dr
Pipe for water main (keybox) raises up every year. I have cut at least 3 feet off it and it still rises up. Raises over a foot every year.	Hans Bohlman	2431 Tasha Dr

The section of my driveway that was done last time (1995ish?) has heaved to the point it's difficult to get out	Warren Searle	2421 Tasha Dr
Other		
Underground water sprinklers in yard and perimeter of yard.	Randy & Mary Nibbelink	8741 Kathleen St
fire hydrant, light pole, mailbox?	Anna and Richard Crocker	2341 Tasha Dr
I am renting and plan to be gone by the end of 2021. Please plan to contact the new tenants at that time.	David Barron	2430 Tasha Drive

Question: What are the top 3 things you would change about Tasha Drive within the project area?

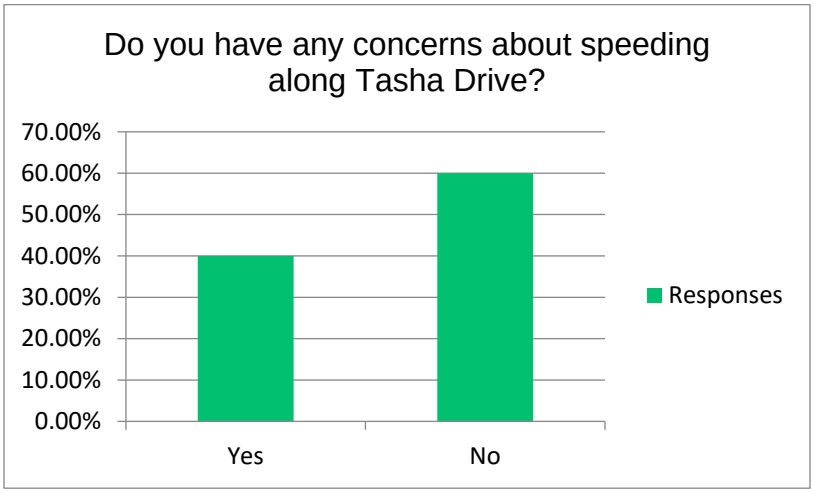
Answered: 12 Skipped: 3

Below are the individual responses, organized by topic:

Drainage
add appropriate drainage
better drainage away from houses/foundation
Drainage
There is a lake in front of my mailbox when rain/melting (Hans Bohlman; 2431 Tasha Dr)
Drains in curb to let water escape. (River in road)
Street Design & Traffic Concerns
Stop sign on Tasha at Flamingo intersection
Speed bump Tasha and Flamingo
add a street sign for Tasha at Northwood
Slow traffic down
Stop sign Tasha and Flamingo
Wider pavement area to allow for occasional street parking
Road Condition
Road surface
Road just needs to be resurfaced
grade & resurface
Repave, dirt everywhere from heaves
Driveable road
Better street less potholes
level the road
Potholes that damage vehicles if you drive in lane
Smooth pavement
levelness
potholes
Lighting
Street lighting review
More lights
more lighting

Question: Do you have any concerns about speeding along Tasha Drive?

Answered: 15 Skipped: 0
Yes: 6 (40%) No: 9 (60%)



Individual responses for five of the six people who said "yes" are below:

Responses
This street is used as a shortcut to Northwood
But definitely speeding on 88th!
People tend to, on occasion, travel fast down Tasha
children at play
Kids ride bikes in road and play in road

Question: Do you think there should be additional space in the roadway for on-street parking within the project limits?

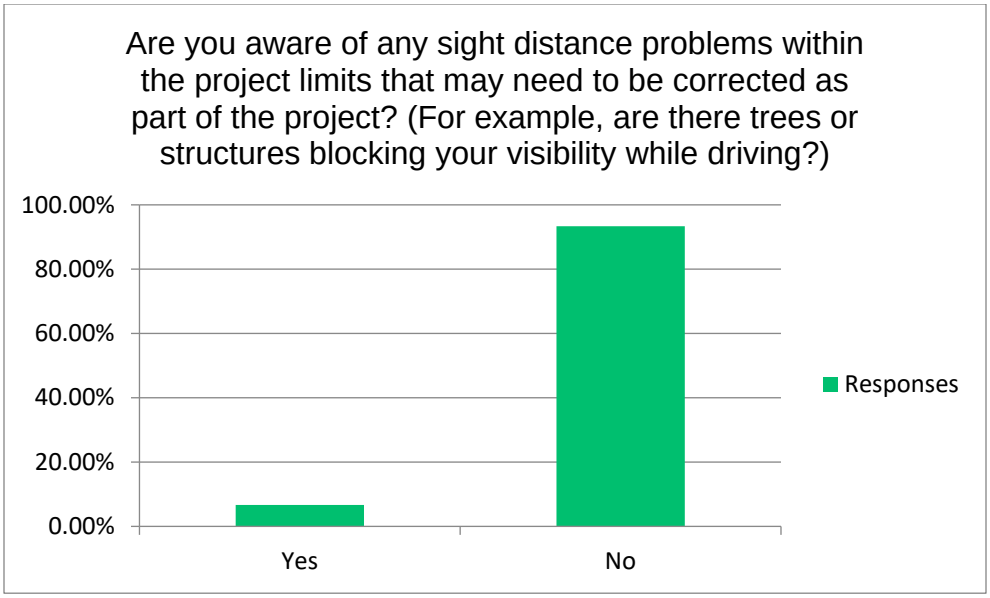
Answered: 15 Skipped: 0
Yes: 3 (20%) No: 12 (80%)

The three people who answered "yes" wrote the following responses:

If yes, please explain where parking should be provided:
?
Occasional on both sides for overflow parking
If feasible, on-street parking is always nice

Question: Are you aware of any sight distance problems within the project limits that may need to be corrected as part of the project? (For example, are there trees or structures blocking your visibility while driving?)

Answered: 15 Skipped: 0
Yes: 1 (7%) No: 14 (93%)

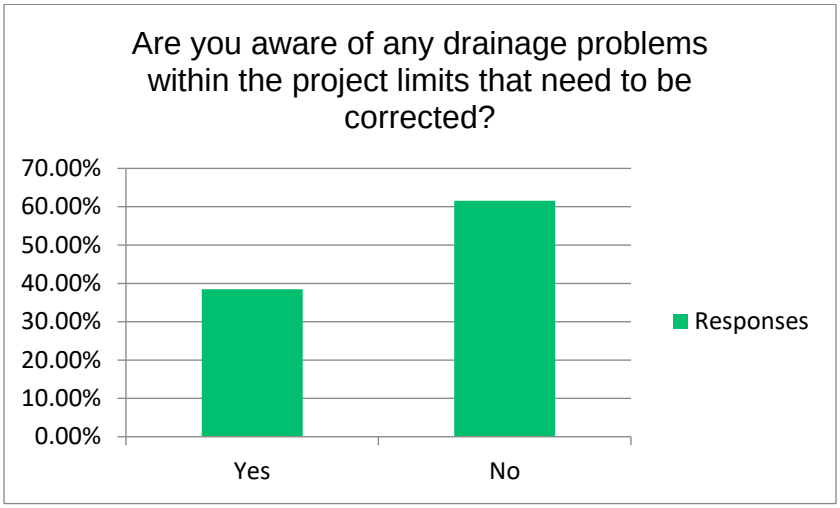


Below is the individual response for the person who answered “yes”:

If yes, please explain:
We need more street lights!!!

Question: Are you aware of any drainage problems within the project limits that need to be corrected?

Answered: 13 Skipped: 2
Yes: 5 (39%) No: 8 (62%)



If yes, please explain:	Name	Address
Water stands in road doesn't drain	Randy & Mary Nibbelink	8741 Kathleen St

Huge puddle forms at Tasha and Northwood that can't drain due to heave/bumps. Same in front of 2341 Tasha.	Anna and Richard Crocker	2341 Tasha Dr
Drainage into our garage	Waters Trust	2440 Tasha Dr
Unsure	Torrine McCarty	2450 Tasha Dr
Giant puddle at Tasha and Northwood, cars have to go around in the opposite lane. If a car turns right on Tasha a head on collision could happen. The house on corner blocks drivers view in both directions. It will happen sooner or later, amazed it has not happened yet.	Hans Bohlman	2431 Tasha Dr
Not that wouldn't be fixed if resurfaced	Warren Searle	2421 Tasha Dr
At the end of street near northwood	Eugene Ragle	2480 Tasha Dr

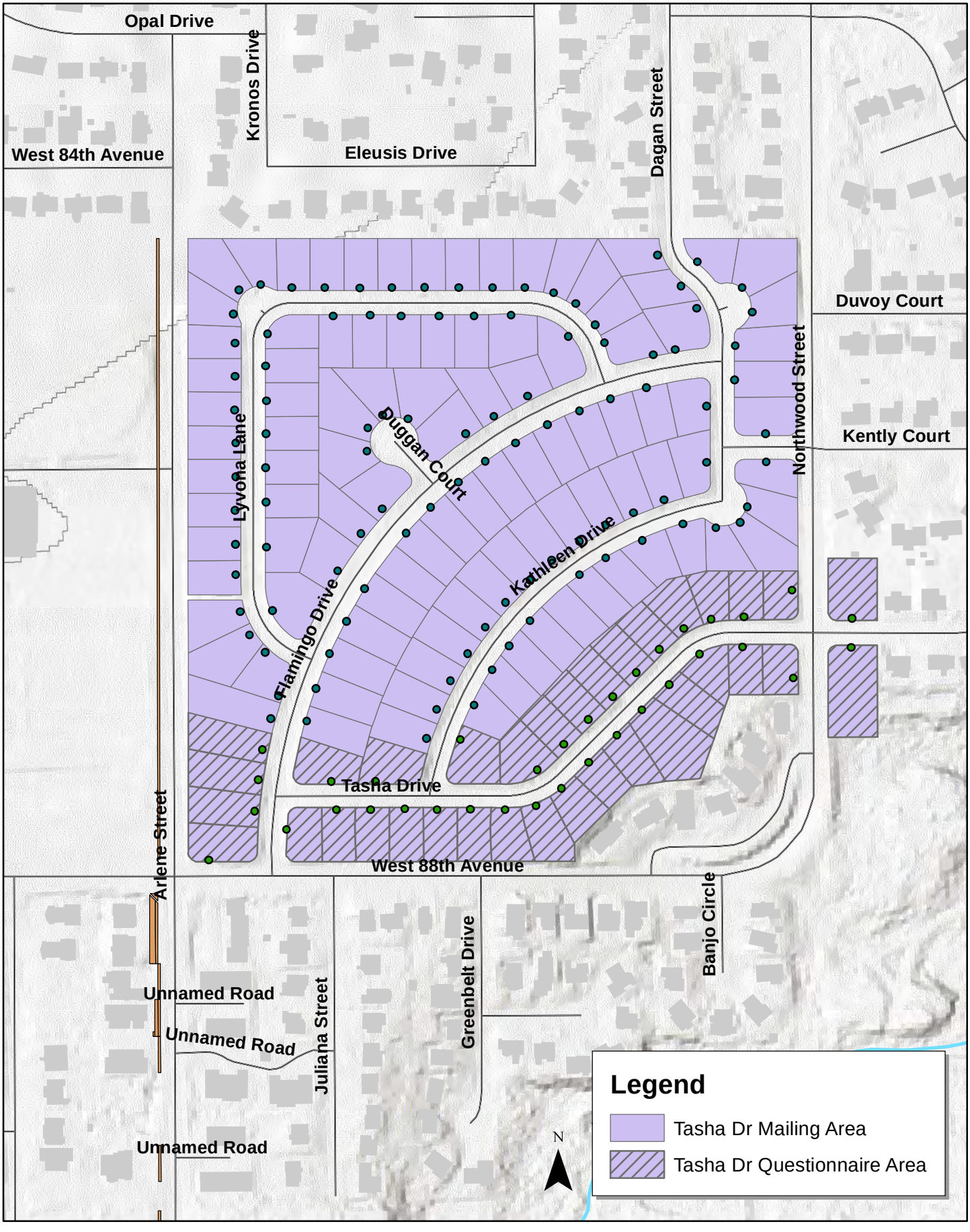
Question: Please include any other comments.

Answered: 4 Skipped: 11

The individual responses for the four people who wrote comments are below:

Responses	Name	Address
How are we going to get to and from our property while street is being redone? How will we get our mail?	Dave and Carolyn Cechowski	2340 Tasha Dr
We're concerned that we have water in our crawl space and our neighbors don't have this problem	Wayne Curley and Linda Rustigan	2590 Tasha Dr
Ground in this area heaves significantly with freeze/thaw	Anneliese Tschannen	2575 Tasha Dr
The funding is available. It's been 25 years since the muni has done this. Every homeowner has paid the taxes dedicated to road maintenance. Fulfil your obligations.	Warren Searle	2421 Tasha Dr

Tasha Drive Reconstruction Mailing Area
138 Parcels
139 Individual Site Addresses
18 Additional Owner Addressees
March 1, 2021
Source, MOA GIS & Property Tax Database



Summary of Driveway Grades

Appendix J

Tasha Drive Reconstruction
MOA Project No. 20-15

DRIVEWAY SUMMARY						
SHEET	PARCEL	CENTERLINE REFERENCE		EXISTING GRADE	PROPOSED GRADE	REMARKS
		STATION	OFFSET			
R1	29	1+71.0	RT	3.52%	2.40%	
R1	1	1+71.5	LT	11.73%	10.75%	
R1	28	2+25.9	RT	2.28%	0.50%	
R1	2	2+54.2	LT	12.93%	12.79%	
R1	27	3+40.0	RT	-3.13%	-0.74%	
R1	26	3+69.5	RT	-4.24%	1.57%	
R1	25	4+68.3	RT	-5.42%	1.12%	
R1	24	5+08.2	RT	-5.03%	0.97%	
R2	23	5+92.9	RT	-3.39%	2.19%	
R2	22	6+21.3	RT	-3.72%	-0.50%	
R2	5	6+44.4	LT	13.55%	12.97%	
R2	21	7+19.7	RT	6.55%	0.84%	
R2	6	7+24.2	LT	8.62%	4.87%	
R2	7	7+62.3	LT	16.19%	15.48%	
R2	20	7+98.2	RT	5.77%	0.50%	
R2	8	8+53.5	LT	2.90%	0.50%	
R2	19	8+71.2	RT	4.16%	0.55%	
R2	9	8+92.0	LT	13.19%	5.38%	
R2	18	9+48.3	RT	6.14%	0.50%	
R2/R3	10	9+98.9	LT	17.98%	8.88%	
R3	11	10+49.6	LT	17.17%	12.43%	
R3	17	10+56.9	RT	10.76%	4.76%	
R3	12	10+95.3	LT	16.13%	8.91%	
R3	13	11+27.8	LT	14.22%	12.07%	
R3	16	11+60.8	RT	11.16%	5.77%	
R3	15	11+96.0	RT	3.63%	0.96%	

Hydrologic & Hydraulic Analysis

Appendix K

Legend

- Confined Space
- Manhole
- Catchbasin Manhole
- Clean-Out
- Catch Basin
- OGS
- Lift Station
- Diverter
- Drywell
- Weir
- Blind Connect
- Top Intake Manhole
- Roof Drain
- Bypass Outlet
- Curb Inlet
- End of Pipe
- Pipe Inlet
- Pipe Cap
- Inlet
- Pipe Outlet
- Control Inlet
- Control Outlet
- Other
- Outfall
- Outfall Major
- Outfall Minor
- Sink -(Closed Drainage Basin)
- Divide
- Feature Start
- Other

Storm Pipes

- ADOT
- ADOT-Airport
- Abandoned
- Fed_Military
- MOA-ASD
- MOA-Facility Maintenance
- MOA-Merrill Field
- MOA-Other
- MOA-Parks and Recreation
- MOA-Port of Anchorage
- MOA-M&O/CBERRRSA/LRSA/SA
- Private
- SOA-Alaska Railroad
- Unknown

Thaw Wire

- MOA-ASD
- MOA-Facility Maintenance
- MOA-M&O/CBERRRSA/LRSA/SA
- MOA-Parks and Recreation
- Private
- Bridge

Constructed Channels

- ADOT
- MOA-M&O/CBERRRSA/LRSA/SA
- MOA-Other
- Port of Alaska; MOA-Port of Alaska
- MOA-M&O/CBERRRSA/LRSA/SA
- Private
- SOA-Alaska Railroad
- Unknown

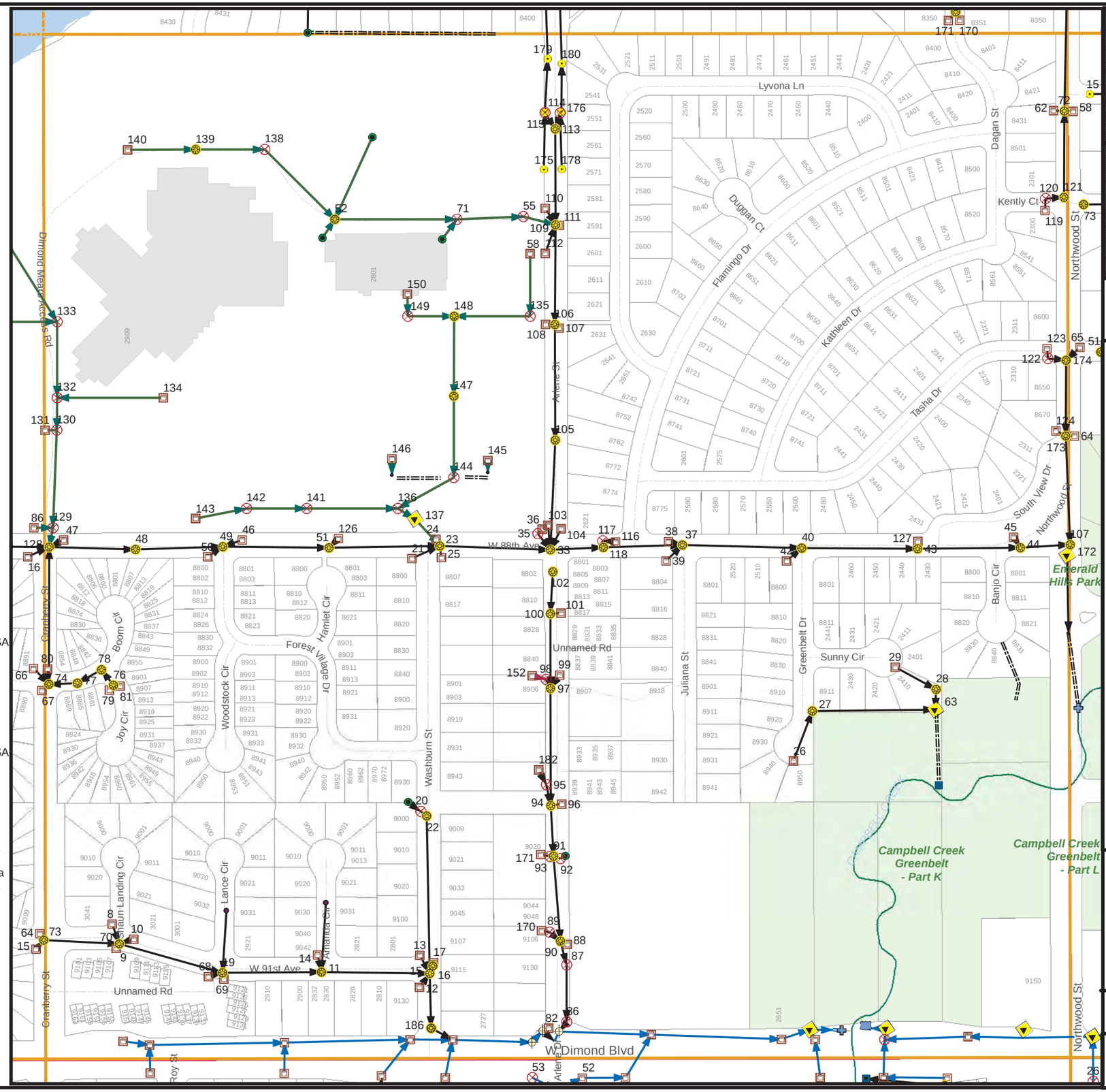
Other Drainageways

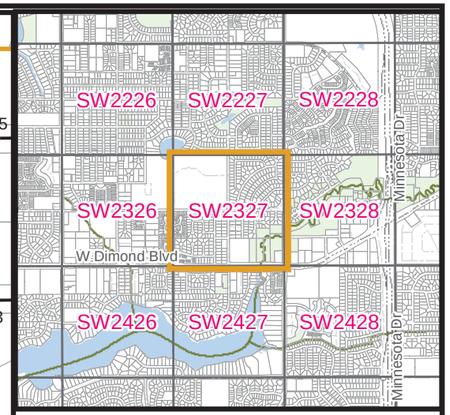
- Other Drainageways

N W E S

0 150 300 600

Feet





Anchorage Bowl
Legal: SE 1/4 Sec11 T12N R4W

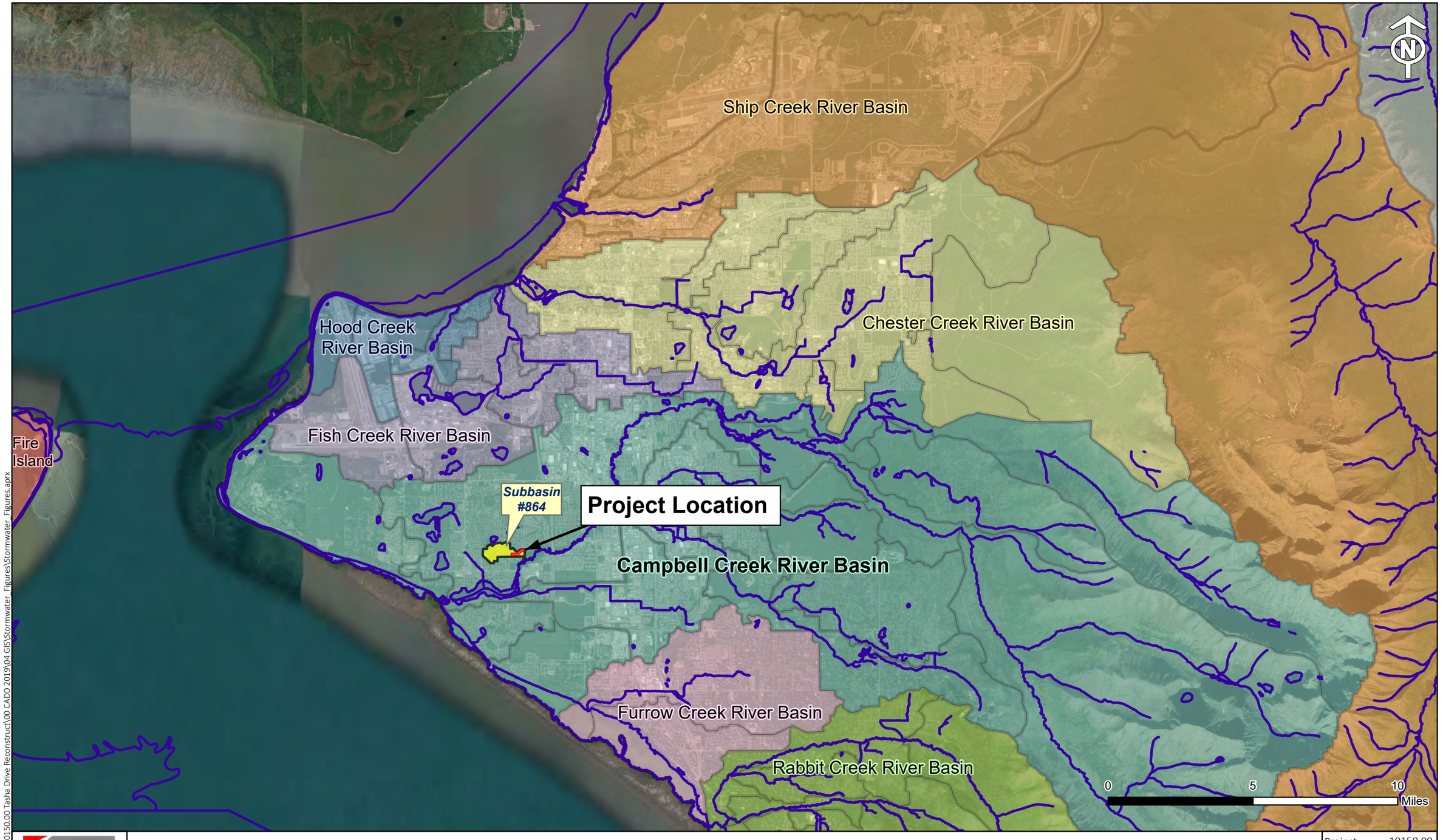
Notes:

MOA Storm Drain and Drainage Atlas

Map Created: 5/23/2020

Grid Number

SW2327



File Path: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\04 GIS\Stormwater_Figures\Stormwater_Figures.aprx

CRW ENGINEERING GROUP, LLC
3490 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

FIGURE 1: PROJECT LOCATION AND MOA WATERSHED BOUNDARY MAP

TASHA DRIVE RECONSTRUCTION DESIGN STUDY MEMO

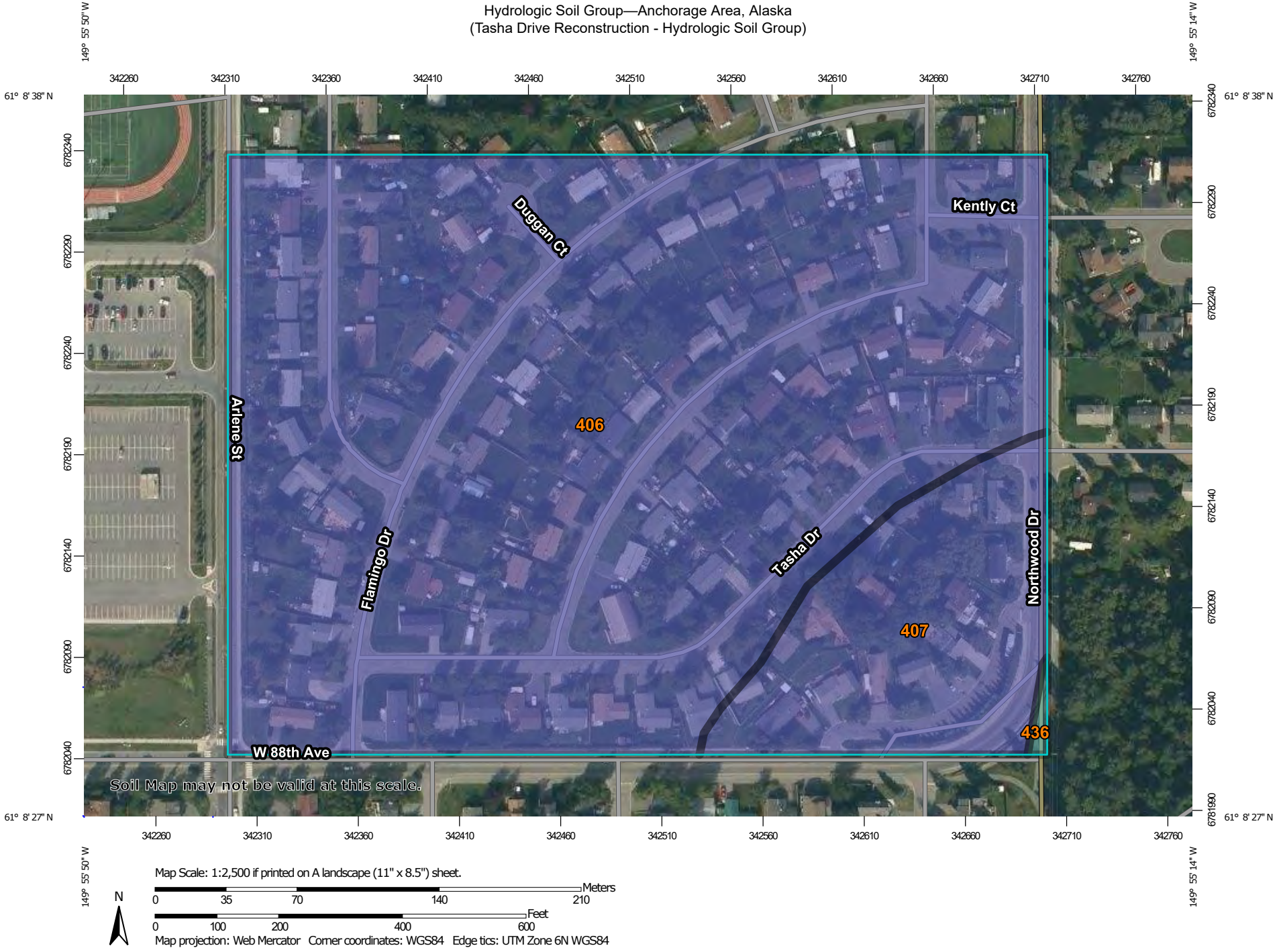
ANCHORAGE, ALASKA

Project:	10150.00
Drawn By:	NRI
Scale:	SHOWN
Date:	10/26/2022
Figure:	1

based on NOAA Atlas 14 data from AIA. A second distribution was developed for Girdwood based on data from the Alyeska station. The resulting hyetographs are presented in Appendix D.

Figure 2 - Orographic Factor Map (Anchorage)

Hydrologic Soil Group—Anchorage Area, Alaska
(Tasha Drive Reconstruction - Hydrologic Soil Group)



Map Scale: 1:2,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 6N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Anchorage Area, Alaska
Survey Area Data: Version 18, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 26, 2011—Aug 29, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
406	Cryorthents and Urban land, 0 to 5 percent slopes	B	25.5	85.4%
407	Cryorthents and Urban land, 5 to 20 percent slopes	B	4.3	14.3%
436	Matsu silt loam, 3 to 7 percent slopes	C	0.1	0.2%
Totals for Area of Interest			**29.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

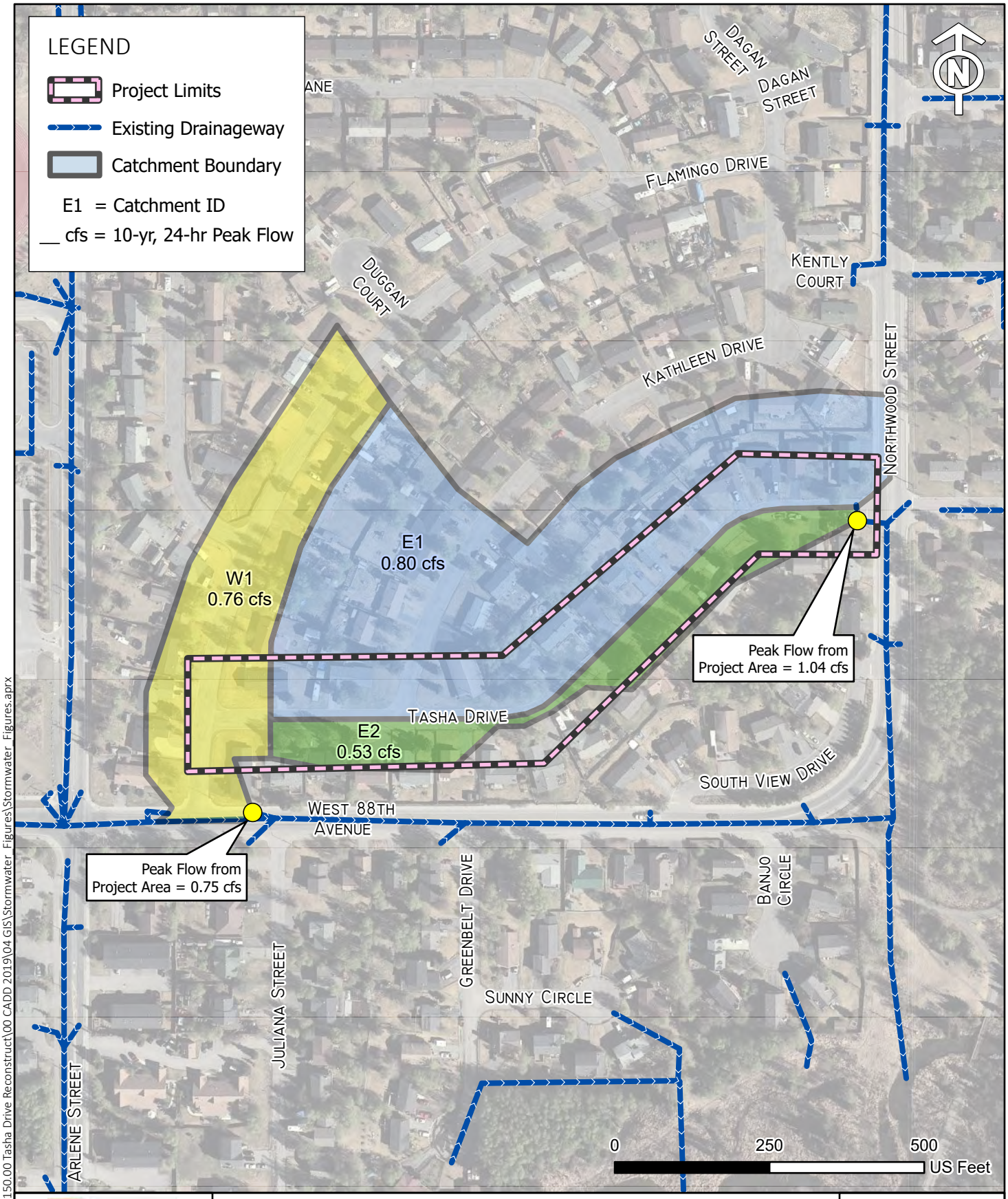
Rating Options

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Existing Conditions



File Path: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\04 GIS\Stormwater_Figures\Stormwater_Figures.aprx

CRW ENGINEERING GROUP, LLC
3490 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

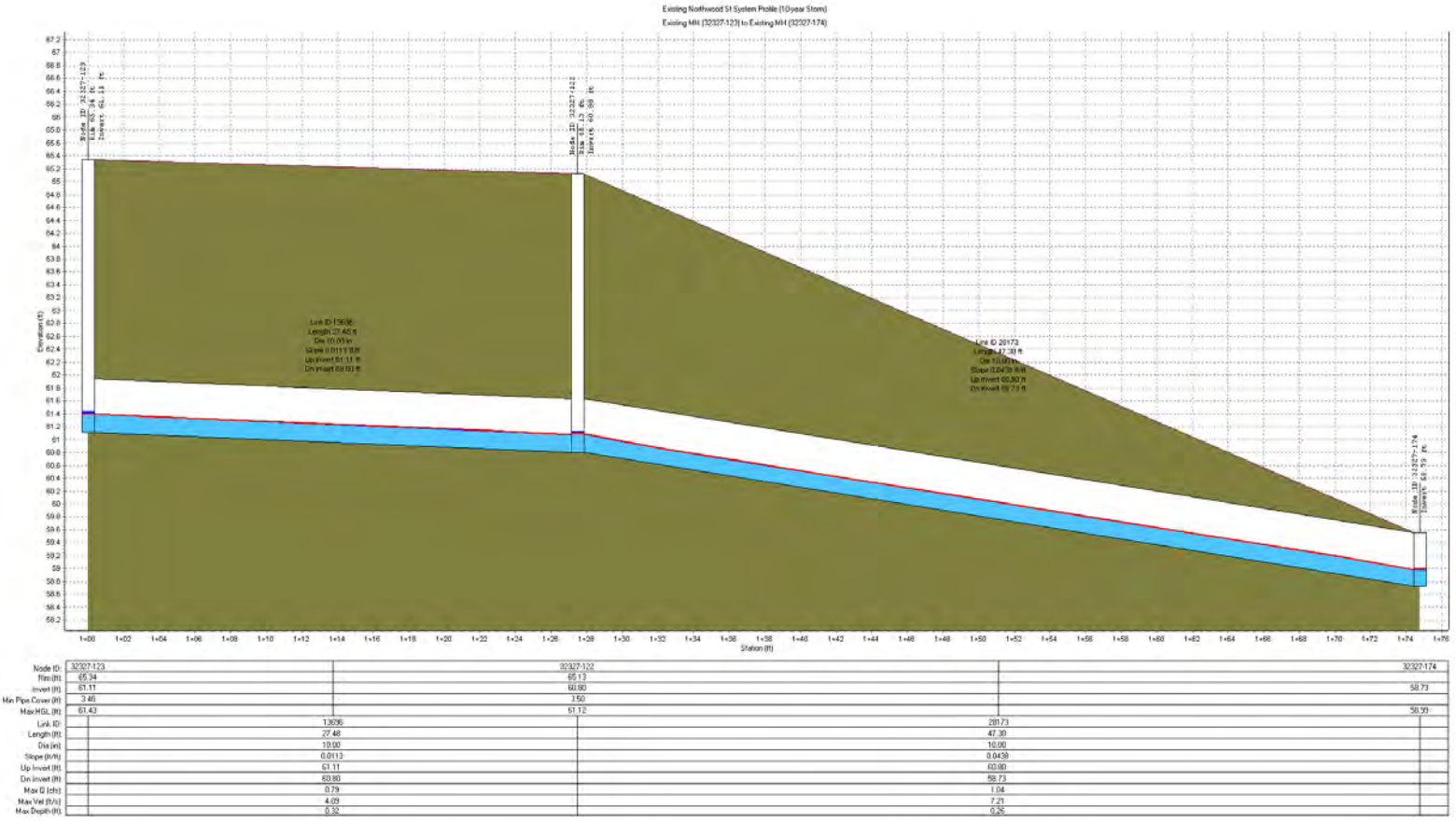
FIGURE 3: EXISTING CONDITIONS MAP

TASHA DRIVE RECONSTRUCTION
DESIGN STUDY MEMO
ANCHORAGE, ALASKA

Project:	10150.00
Drawn By:	NRI
Scale:	SHOWN
Date:	10/27/2022
Figure:	3

EXISTING CONDITIONS

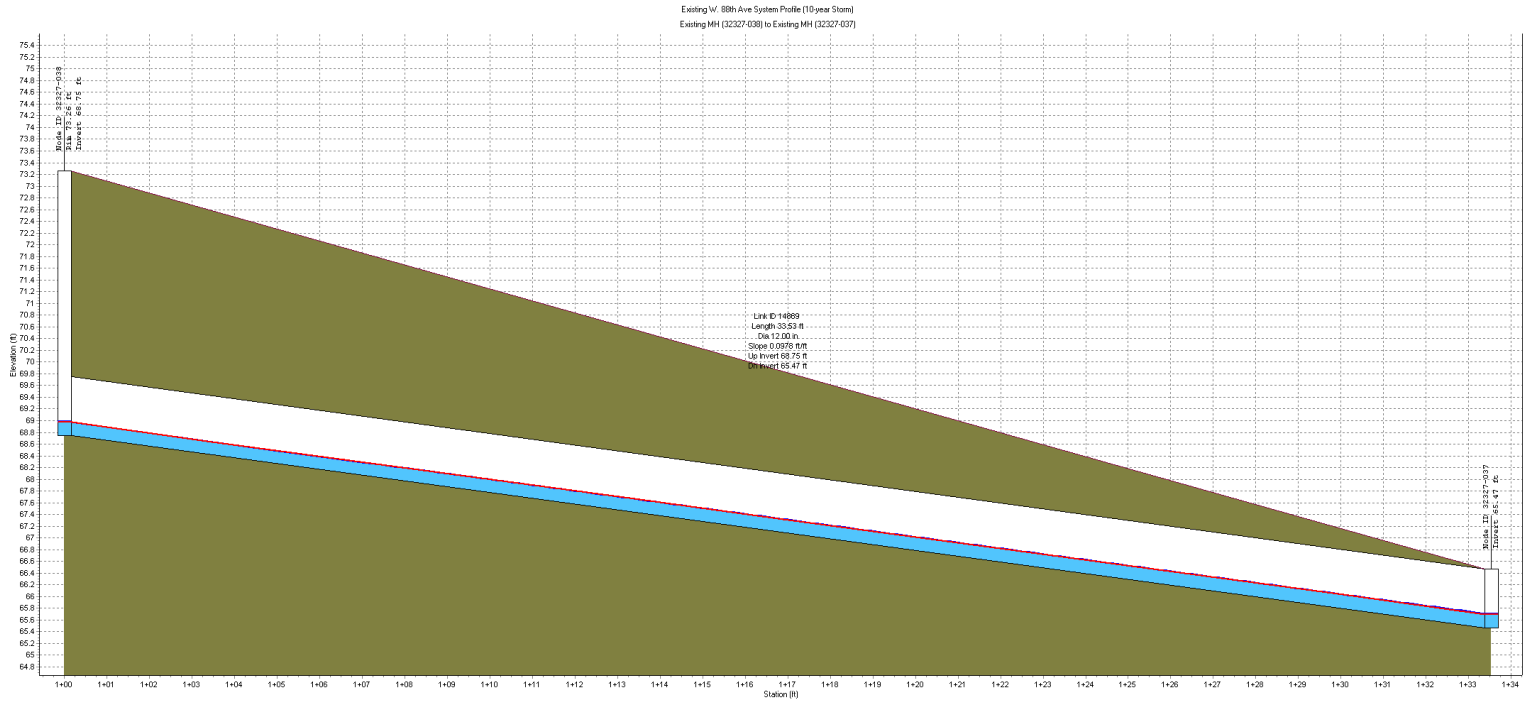
NORTHWOOD STREET SYSTEM (10-YEAR STORM)
MH 32327-123 TO MH 32327-174



Node ID:	32327-123	32327-122	32327-174
Rim (ft):	65.34	65.13	
Invert (ft):	61.11	60.80	58.73
Min Pipe Cover (ft):	3.46	3.50	
Max HGL (ft):	61.43	61.12	58.99
Link ID:	13836	28173	
Length (ft):	27.48	47.30	
Dia (in):	10.00	10.00	
Slope (ft/ft):	0.0113	0.0438	
Up Invert (ft):	61.11	60.80	
Dn Invert (ft):	60.80	58.73	
Max Q (cfs):	0.79	1.04	
Max Vel (ft/s):	4.03	7.21	
Max Depth (ft):	0.32	0.26	

EXISTING CONDITIONS

W. 88TH AVE. SYSTEM (10-YEAR STORM)
MH 32327-038 TO MH 32327-037



Node ID:	32327-038	32327-037
Rim (ft):	73.26	
Invert (ft):	68.75	65.47
Min Pipe Cover (ft):	3.51	
Max HGL (ft):	68.99	65.71
Link ID:	14869	
Length (ft):	33.53	
Dia (in):	12.00	
Slope (ft/ft):	0.0978	
Up Invert (ft):	68.75	
Dn Invert (ft):	65.47	
Max Q (cfs):	0.75	
Max Vel (ft/s):	5.24	
Max Depth (ft):	0.24	

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... 10150.00 Existing Conditions_SSA Model (10-23-2022).SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date AUG-24-2021 00:00:00
Ending Date AUG-25-2021 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 3
Number of nodes 5
Number of links 3

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	10-year cumulative storm for Anchorage	CUMULATIVE	6.00

****
Subbasin Summary
****

Subbasin ID	Total Area acres
E1	4.73
E2	1.84
W1	2.83

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
32327-038	JUNCTION	68.75	73.26	0.00	
32327-122	JUNCTION	60.80	65.13	0.00	
32327-123	JUNCTION	61.11	65.34	0.00	
32327-037	OUTFALL	65.47	66.47	0.00	
32327-174	OUTFALL	58.73	59.56	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
13696	32327-123	32327-122	CONDUIT	27.5	1.1281	0.0120
14869	32327-038	32327-037	CONDUIT	33.5	9.7823	0.0240
28173	32327-122	32327-174	CONDUIT	47.3	4.3763	0.0120

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
13696	CIRCULAR	0.83	0.83	1	0.55	0.21	2.52
14869	CIRCULAR	1.00	1.00	1	0.79	0.25	6.04
28173	CIRCULAR	0.83	0.83	1	0.55	0.21	4.97

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	1.788	2.283
Surface Runoff	0.051	0.065
Continuity Error (%)	-0.000	

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.510	0.166
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin E1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	4.02	B	75.00
Paved roads with curbs & sewers	0.71	B	98.00
Composite Area & Weighted CN	4.73		78.45

Subbasin E2

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	1.56	B	75.00
Paved roads with curbs & sewers	0.28	B	98.00
Composite Area & Weighted CN	1.84		78.45

Subbasin W1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	2.41	B	75.00
Paved roads with curbs & sewers	0.42	B	98.00
Composite Area & Weighted CN	2.83		78.45

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)

Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin E1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	204.00	0.00	0.00
Slope (%):	2.70	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.40	1.50	1.50
Velocity (ft/sec):	0.07	0.00	0.00
Computed Flow Time (minutes):	50.93	0.00	0.00

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.01	0.00	0.00
Flow Length (ft):	1145.00	0.00	0.00
Channel Slope (%):	1.00	0.00	0.00
Cross Section Area (ft²):	1.05	0.00	0.00
Wetted Perimeter (ft):	10.02	0.00	0.00
Velocity (ft/sec):	2.55	0.00	0.00
Computed Flow Time (minutes):	7.49	0.00	0.00

==========
Total TOC (minutes): 58.42
==========

Subbasin E2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	39.00	0.00	0.00
Slope (%):	2.00	0.00	

0.00

2 yr, 24 hr Rainfall (in):	1.40	1.40	
1.40			
Velocity (ft/sec):	0.04	0.00	
0.00			
Computed Flow Time (minutes):	15.29	0.00	
0.00			

Channel Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.01	0.00	
0.00			
Flow Length (ft):	1062.00	0.00	
0.00			
Channel Slope (%):	1.00	0.00	
0.00			
Cross Section Area (ft²):	1.05	0.00	
0.00			
Wetted Perimeter (ft):	10.02	0.00	
0.00			
Velocity (ft/sec):	2.55	0.00	
0.00			
Computed Flow Time (minutes):	6.95	0.00	
0.00			

==========

Total TOC (minutes):	22.23

==========

Subbasin W1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.40	0.00	
0.00			
Flow Length (ft):	75.00	0.00	
0.00			
Slope (%):	3.51	0.00	
0.00			
2 yr, 24 hr Rainfall (in):	1.40	1.50	
1.50			
Velocity (ft/sec):	0.06	0.00	
0.00			
Computed Flow Time (minutes):	20.59	0.00	
0.00			

Channel Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.01	0.00	
0.00			
Flow Length (ft):	736.00	0.00	
0.00			
Channel Slope (%):	1.00	0.00	
0.00			
Cross Section Area (ft²):	1.05	0.00	
0.00			
Wetted Perimeter (ft):	10.02	0.00	

0.00

	Velocity (ft/sec):	2.55	0.00
0.00			
	Computed Flow Time (minutes):	4.82	0.00
0.00			

	Total TOC (minutes):	25.41

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
E1	2.28	0.67	0.80	78.450	0	00:58:25
E2	2.28	0.67	0.53	78.450	0	00:22:13
W1	2.28	0.67	0.76	78.450	0	00:25:24

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
32327-038	0.06	0.24	68.99	0	12:25	0	0	0:00:00
32327-122	0.09	0.32	61.12	0	12:45	0	0	0:00:00
32327-123	0.09	0.32	61.43	0	12:45	0	0	0:00:00
32327-037	0.06	0.24	65.71	0	12:25	0	0	0:00:00
32327-174	0.08	0.26	58.99	0	12:34	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
32327-038	JUNCTION	0.75	0.75	0	12:25	0.00		
32327-122	JUNCTION	0.52	1.04	0	12:35	0.00		
32327-123	JUNCTION	0.79	0.79	0	12:45	0.00		
32327-037	OUTFALL	0.00	0.75	0	12:25	0.00		
32327-174	OUTFALL	0.00	1.04	0	12:34	0.00		

****
Outfall Loading Summary
****

Outfall Node ID	Flow	Average	Peak

	Frequency (%)	Flow cfs	Inflow cfs
32327-037	61.85	0.13	0.75
32327-174	61.78	0.29	1.04
System	61.82	0.42	1.77

****
Link Flow Summary
****

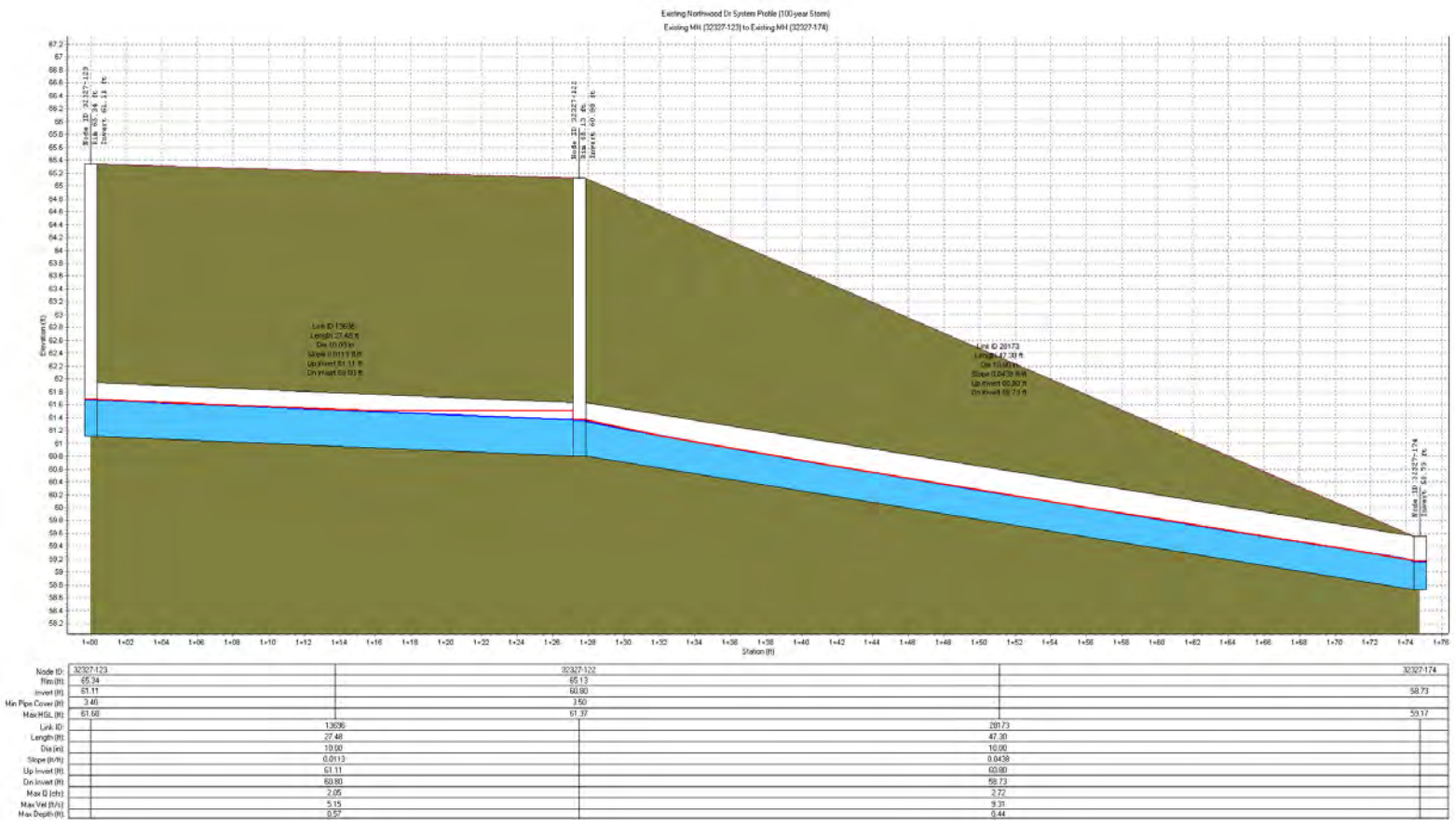
Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time Surcharged minutes	Reported Condition
13696	CONDUIT	0 12:45	4.09	1.00	0.79	2.52	0.31	0.39	0	Calculated
14869	CONDUIT	0 12:25	5.24	1.00	0.75	6.04	0.12	0.24	0	Calculated
28173	CONDUIT	0 12:34	7.21	1.00	1.04	4.97	0.21	0.31	0	Calculated

****
Highest Flow Instability Indexes
****
Link 28173 (1)

Analysis began on: Wed Oct 26 21:26:30 2022
Analysis ended on: Wed Oct 26 21:26:32 2022
Total elapsed time: 00:00:02

EXISTING CONDITIONS

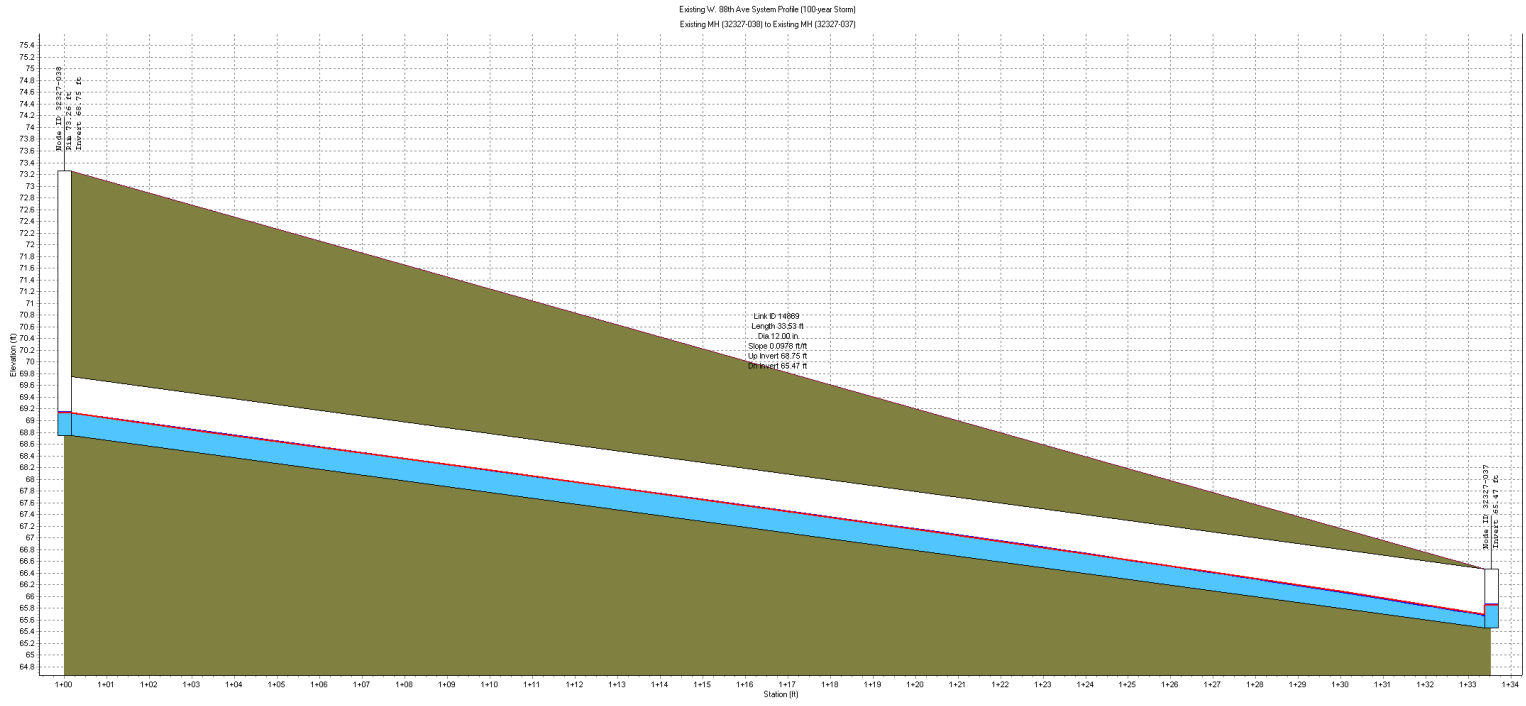
NORTHWOOD DR. SYSTEM (100-YEAR STORM)
MH 32327-123 TO MH 32327-174



Node ID:	32327-123	32327-122	32327-174
Rim (ft):	65.34	65.13	
Invert (ft):	61.11	60.80	58.73
Min Pipe Cover (ft):	3.46	3.50	
Max HGL (ft):	61.58	61.37	59.17
Link ID:	13636	28173	
Length (ft):	27.48	47.30	
Dia (in):	10.00	10.00	
Slope (ft/ft):	0.0113	0.0438	
Up Invert (ft):	61.11	60.80	
Dn Invert (ft):	60.80	58.73	
Max Q (cfs):	2.05	2.72	
Max Vel (ft/s):	5.15	9.31	
Max Depth (ft):	0.57	0.44	

EXISTING CONDITIONS

W. 88TH AVE. SYSTEM (100-YEAR STORM)
MH 32327-038 TO MH 32327-037



Node ID:	32327-038	32327-037
Rim (ft):	73.26	
Invert (ft):	68.75	65.47
Min Pipe Cover (ft):	3.51	
Max HGL (ft):	68.14	65.86
Link ID:	14869	
Length (ft):	33.53	
Dia (in):	12.00	
Slope (ft/ft):	0.0978	
Up Invert (ft):	68.75	
Dn Invert (ft):	65.47	
Max Q (cfs):	1.92	
Max Vel (ft/s):	6.82	
Max Depth (ft):	0.39	

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... 10150.00 Existing Conditions_SSA Model (10-23-2022).SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date AUG-24-2021 00:00:00
Ending Date AUG-25-2021 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 3
Number of nodes 5
Number of links 3

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	100-year cumulative storm for Anchorage	CUMULATIVE	6.00

****
Subbasin Summary
****

Subbasin ID	Total Area acres
E1	4.73
E2	1.84
W1	2.83

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
32327-038	JUNCTION	68.75	73.26	0.00	
32327-122	JUNCTION	60.80	65.13	0.00	
32327-123	JUNCTION	61.11	65.34	0.00	
32327-037	OUTFALL	65.47	66.47	0.00	
32327-174	OUTFALL	58.73	59.56	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
13696	32327-123	32327-122	CONDUIT	27.5	1.1281	0.0120
14869	32327-038	32327-037	CONDUIT	33.5	9.7823	0.0240
28173	32327-122	32327-174	CONDUIT	47.3	4.3763	0.0120

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
13696	CIRCULAR	0.83	0.83	1	0.55	0.21	2.52
14869	CIRCULAR	1.00	1.00	1	0.79	0.25	6.04
28173	CIRCULAR	0.83	0.83	1	0.55	0.21	4.97

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	2.817	3.596
Surface Runoff	0.123	0.157
Continuity Error (%)	-0.001	

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	1.225	0.399
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin E1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	4.02	B	75.00
Paved roads with curbs & sewers	0.71	B	98.00
Composite Area & Weighted CN	4.73		78.45

Subbasin E2

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	1.56	B	75.00
Paved roads with curbs & sewers	0.28	B	98.00
Composite Area & Weighted CN	1.84		78.45

Subbasin W1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	2.41	B	75.00
Paved roads with curbs & sewers	0.42	B	98.00
Composite Area & Weighted CN	2.83		78.45

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)

Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin E1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	204.00	0.00	0.00
Slope (%):	2.70	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.40	1.50	1.50
Velocity (ft/sec):	0.07	0.00	0.00
Computed Flow Time (minutes):	50.93	0.00	0.00

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.01	0.00	0.00
Flow Length (ft):	1145.00	0.00	0.00
Channel Slope (%):	1.00	0.00	0.00
Cross Section Area (ft²):	1.05	0.00	0.00
Wetted Perimeter (ft):	10.02	0.00	0.00
Velocity (ft/sec):	2.55	0.00	0.00
Computed Flow Time (minutes):	7.49	0.00	0.00

==========
Total TOC (minutes): 58.42
==========

Subbasin E2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	39.00	0.00	0.00
Slope (%):	2.00	0.00	

0.00

2 yr, 24 hr Rainfall (in):	1.40	1.40	
1.40			
Velocity (ft/sec):	0.04	0.00	
0.00			
Computed Flow Time (minutes):	15.29	0.00	
0.00			

Channel Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.01	0.00	
0.00			
Flow Length (ft):	1062.00	0.00	
0.00			
Channel Slope (%):	1.00	0.00	
0.00			
Cross Section Area (ft²):	1.05	0.00	
0.00			
Wetted Perimeter (ft):	10.02	0.00	
0.00			
Velocity (ft/sec):	2.55	0.00	
0.00			
Computed Flow Time (minutes):	6.95	0.00	
0.00			

==========

Total TOC (minutes):	22.23

==========

Subbasin W1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.40	0.00	
0.00			
Flow Length (ft):	75.00	0.00	
0.00			
Slope (%):	3.51	0.00	
0.00			
2 yr, 24 hr Rainfall (in):	1.40	1.50	
1.50			
Velocity (ft/sec):	0.06	0.00	
0.00			
Computed Flow Time (minutes):	20.59	0.00	
0.00			

Channel Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.01	0.00	
0.00			
Flow Length (ft):	736.00	0.00	
0.00			
Channel Slope (%):	1.00	0.00	
0.00			
Cross Section Area (ft²):	1.05	0.00	
0.00			
Wetted Perimeter (ft):	10.02	0.00	

0.00

	Velocity (ft/sec):	2.55	0.00
0.00			
	Computed Flow Time (minutes):	4.82	0.00
0.00			

	Total TOC (minutes):	25.41

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
E1	3.59	1.60	2.05	78.450	0	00:58:25
E2	3.59	1.60	1.36	78.450	0	00:22:13
W1	3.59	1.60	1.95	78.450	0	00:25:24

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
32327-038	0.09	0.39	69.14	0	12:25	0	0	0:00:00
32327-122	0.16	0.57	61.37	0	12:45	0	0	0:00:00
32327-123	0.16	0.57	61.68	0	12:45	0	0	0:00:00
32327-037	0.09	0.39	65.86	0	12:25	0	0	0:00:00
32327-174	0.13	0.44	59.17	0	12:30	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
32327-038	JUNCTION	1.92	1.92	0	12:25	0.00		
32327-122	JUNCTION	1.35	2.72	0	12:30	0.00		
32327-123	JUNCTION	2.05	2.05	0	12:45	0.00		
32327-037	OUTFALL	0.00	1.92	0	12:25	0.00		
32327-174	OUTFALL	0.00	2.72	0	12:30	0.00		

****
Outfall Loading Summary
****

Outfall Node ID	Flow	Average	Peak

	Frequency (%)	Flow cfs	Inflow cfs
32327-037	73.00	0.26	1.92
32327-174	72.72	0.59	2.72
System	72.86	0.85	4.62

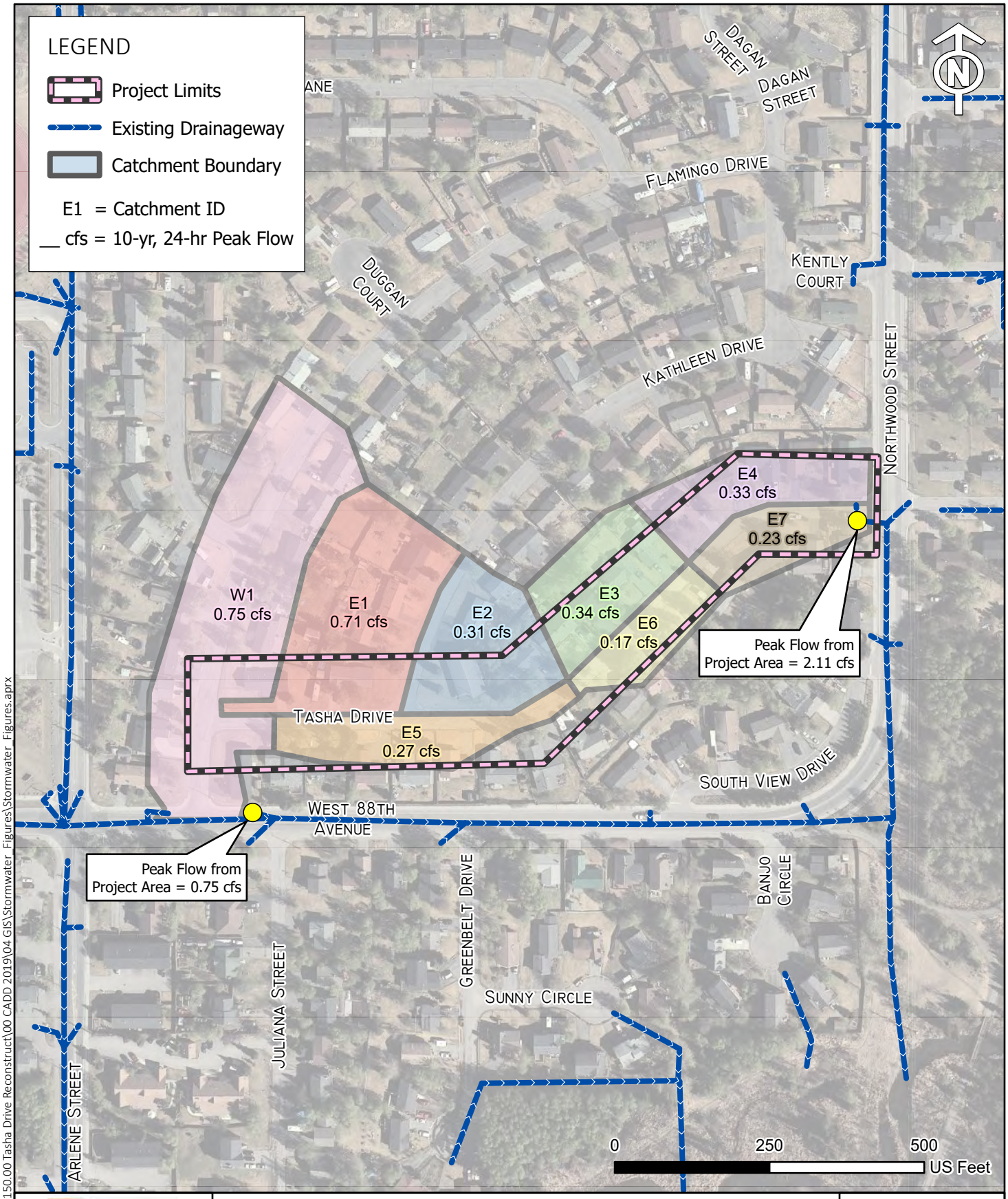
****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time minutes	Reported Condition
13696	CONDUIT	0 12:45	5.15	1.00	2.05	2.52	0.81	0.69	0	Calculated
14869	CONDUIT	0 12:25	6.82	1.00	1.92	6.04	0.32	0.39	0	Calculated
28173	CONDUIT	0 12:30	9.31	1.00	2.72	4.97	0.55	0.53	0	Calculated

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Wed Oct 26 21:36:21 2022
Analysis ended on: Wed Oct 26 21:36:23 2022
Total elapsed time: 00:00:02

Proposed Conditions



File Path: J:\JobsData\10150.00 Tasha Drive Reconstruct\00 CADD 2019\04 GIS\Stormwater_Figures\Stormwater_Figures.aprx

CRW ENGINEERING GROUP, LLC
3490 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE (907) 562-3252
#AECL882-AK

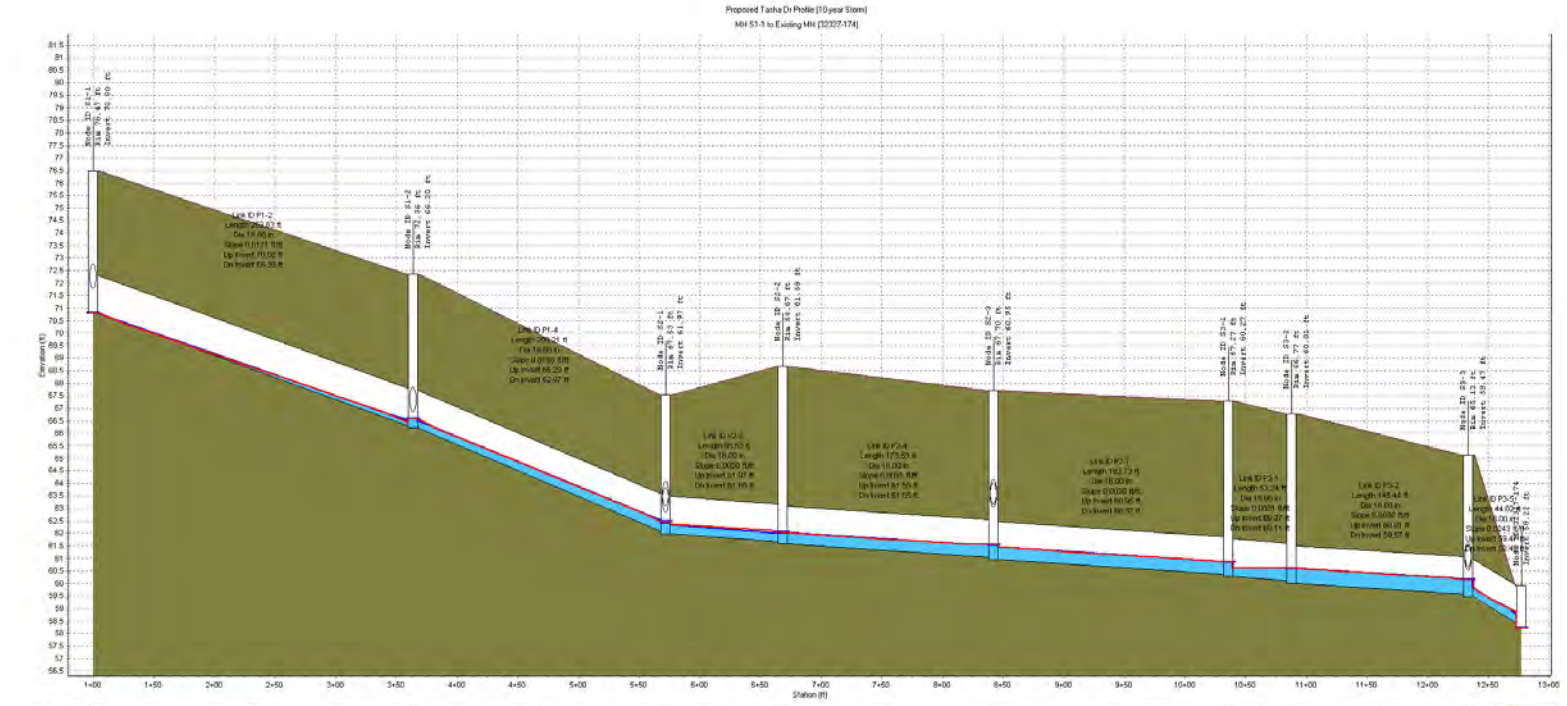
FIGURE 4: PROPOSED CONDITIONS MAP

TASHA DRIVE RECONSTRUCTION
DESIGN STUDY MEMO
ANCHORAGE, ALASKA

Project:	10150.00
Drawn By:	NRI
Scale:	SHOWN
Date:	10/27/2022
Figure:	4

PROPOSED CONDITIONS

TASHA DR. SYSTEM (10-YEAR STORM)
MH S1-1 TO MH 32327-174



Node ID:	S1-1		S1-2		S2-1	S2-2	S2-3		S3-1	S3-2		S3-3	32327-174
Rim (ft)	76.47		72.36		67.53	68.67	67.70		67.27	66.77		65.13	
Invert (ft)	70.80		66.20		61.97	61.58	60.95		60.27	60.01		59.47	58.22
Min Pipe Cover (ft)	3.72		4.52		3.45	5.49	3.55		5.40	5.16		3.49	
Max HGL (ft)	70.80		66.57		62.47	62.06	61.56		60.95	60.66		60.15	58.22
Link ID:	P1-2	P1-4		P2-3	P2-4	P2-7		P3-1	P3-2		P3-5		
Length (ft)	263.83	208.21		86.53	173.53	193.73		52.24	145.44		44.02		
Dia (in)	18.00	18.00		18.00	18.00	18.00		18.00	18.00		18.00		
Slope (ft/ft)	0.0171	0.0138		0.0030	0.0031	0.0030		0.0031	0.0030		0.0243		
Up Invert (ft)	70.80	66.20		61.97	61.58	60.95		60.27	60.01		59.47		
Dn Invert (ft)	66.30	62.07		61.68	61.05	60.37		60.11	59.57		58.40		
Max Q (cfs)	0.00	0.79		1.24	1.23	1.68		1.68	1.68		2.11		
Max Vel (ft/s)	0.00	2.38		2.73	2.57	2.94		2.87	2.61		3.96		
Max Depth (ft)	0.14	0.38		0.45	0.47	0.55		0.55	0.59		0.51		

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... 10150.00 Proposed Conditions_SSA Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date OCT-26-2022 00:00:00
Ending Date OCT-27-2022 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 8
Number of nodes 19
Number of links 17

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Tasha_Drive	10-year, 24-hour Design Storm	CUMULATIVE	6.00

****
Subbasin Summary
****

Subbasin ID	Total Area acres
E1	1.74
E2	0.75
E3	0.82
E4	0.80
E5	0.67
E6	0.40
E7	0.57
W1	2.81

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
32327-038	JUNCTION	68.75	73.26	0.00	

I1-1	JUNCTION	72.08	76.92	0.00
I1-2	JUNCTION	67.47	72.55	0.00
I2-1	JUNCTION	63.23	68.66	0.00
I2-2	JUNCTION	63.24	68.05	0.00
I2-3	JUNCTION	63.34	67.46	0.00
I2-4	JUNCTION	63.34	67.18	0.00
I3-1	JUNCTION	60.83	65.36	0.00
I3-2	JUNCTION	60.83	64.81	0.00
S1-1	JUNCTION	70.80	76.47	0.00
S1-2	JUNCTION	66.20	72.36	0.00
S2-1	JUNCTION	61.97	67.53	0.00
S2-2	JUNCTION	61.58	68.67	0.00
S2-3	JUNCTION	60.95	67.70	0.00
S3-1	JUNCTION	60.27	67.27	0.00
S3-2	JUNCTION	60.01	66.77	0.00
S3-3	JUNCTION	59.47	65.13	0.00
32327-037	OUTFALL	65.47	66.47	0.00
32327-174	OUTFALL	58.22	59.90	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
14869	32327-038	32327-037	CONDUIT	33.5	9.7823	0.0240
P1-1	I1-1	S1-1	CONDUIT	16.4	2.0159	0.0120
P1-2	S1-1	S1-2	CONDUIT	263.8	1.7056	0.0120
P1-3	I1-2	S1-2	CONDUIT	31.1	2.0262	0.0120
P1-4	S1-2	S2-1	CONDUIT	208.2	1.9836	0.0120
P2-1	I2-1	S2-1	CONDUIT	20.2	2.0291	0.0120
P2-2	I2-2	S2-1	CONDUIT	8.0	2.0000	0.0120
P2-3	S2-1	S2-2	CONDUIT	96.5	0.3000	0.0120
P2-4	S2-2	S2-3	CONDUIT	173.5	0.3054	0.0120
P2-5	I2-3	S2-3	CONDUIT	15.5	2.0000	0.0120
P2-6	I2-4	S2-3	CONDUIT	9.5	2.0000	0.0120
P2-7	S2-3	S3-1	CONDUIT	193.7	0.2994	0.0120
P3-1	S3-1	S3-2	CONDUIT	52.2	0.3063	0.0120
P3-2	S3-2	S3-3	CONDUIT	145.4	0.3025	0.0120
P3-3	I3-1	S3-3	CONDUIT	15.5	2.0000	0.0120
P3-4	I3-2	S3-3	CONDUIT	9.5	2.0000	0.0120
P3-5	S3-3	32327-174	CONDUIT	44.0	2.4305	0.0120

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
14869	CIRCULAR	1.00	1.00	1	0.79	0.25	6.04
P1-1	CIRCULAR	1.00	1.00	1	0.79	0.25	5.48
P1-2	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
P1-3	CIRCULAR	1.00	1.00	1	0.79	0.25	5.49

P1-4	CIRCULAR	1.50	1.50	1	1.77	0.38
16.03						
P2-1	CIRCULAR	1.00	1.00	1	0.79	0.25
5.50						
P2-2	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P2-3	CIRCULAR	1.50	1.50	1	1.77	0.38
6.23						
P2-4	CIRCULAR	1.50	1.50	1	1.77	0.38
6.29						
P2-5	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P2-6	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P2-7	CIRCULAR	1.50	1.50	1	1.77	0.38
6.23						
P3-1	CIRCULAR	1.50	1.50	1	1.77	0.38
6.30						
P3-2	CIRCULAR	1.50	1.50	1	1.77	0.38
6.26						
P3-3	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P3-4	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P3-5	CIRCULAR	1.50	1.50	1	1.77	0.38
17.74						

*************************	Volume	Depth
Runoff Quantity Continuity	acre-ft	inches
*************************	---------	-------
Total Precipitation	1.626	2.282
Surface Runoff	0.008	0.011
Continuity Error (%)	-0.000	

*************************	Volume	Volume
Flow Routing Continuity	acre-ft	Mgallons
*************************	---------	---------
External Inflow	0.000	0.000
External Outflow	0.470	0.153
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.002	0.001
Continuity Error (%)	-0.002	

****
Composite Curve Number Computations Report
****

Subbasin E1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	1.48	B	75.00
Paved roads with curbs & sewers	0.26	B	98.00
Composite Area & Weighted CN	1.74		78.45

Subbasin E2

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.63	B	75.00

Paved roads with curbs & sewers	0.11	B	98.00
Composite Area & Weighted CN	0.75		78.45

Subbasin E3

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.70	B	75.00
Paved roads with curbs & sewers	0.12	B	98.00
Composite Area & Weighted CN	0.82		78.45

Subbasin E4

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.68	B	75.00
Paved roads with curbs & sewers	0.12	B	98.00
Composite Area & Weighted CN	0.79		78.45

Subbasin E5

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.57	B	75.00
Paved roads with curbs & sewers	0.10	B	98.00
Composite Area & Weighted CN	0.67		78.45

Subbasin E6

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.34	B	75.00
Paved roads with curbs & sewers	0.06	B	98.00
Composite Area & Weighted CN	0.40		78.45

Subbasin E7

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.48	B	75.00
Paved roads with curbs & sewers	0.09	B	98.00
Composite Area & Weighted CN	0.57		78.45

Subbasin W1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	2.39	B	75.00
Paved roads with curbs & sewers	0.42	B	98.00
Composite Area & Weighted CN	2.81		78.45

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin E1

User-Defined TOC override (minutes): 10.00

Subbasin E2

User-Defined TOC override (minutes): 10.00

Subbasin E3

User-Defined TOC override (minutes): 10.00

Subbasin E4

User-Defined TOC override (minutes): 10.00

Subbasin E5

User-Defined TOC override (minutes): 10.00

Subbasin E6

User-Defined TOC override (minutes): 10.00

Subbasin E7

User-Defined TOC override (minutes): 10.00

Subbasin W1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	75.00	0.00	0.00
Slope (%):	3.51	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.40	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	20.59	0.00	0.00

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.01	0.00	0.00
Flow Length (ft):	736.00	0.00	0.00
Channel Slope (%):	1.00	0.00	0.00
Cross Section Area (ft²):	1.05	0.00	0.00
Wetted Perimeter (ft):	10.02	0.00	0.00
Velocity (ft/sec):	2.55	0.00	0.00
Computed Flow Time (minutes):	4.82	0.00	0.00

Total TOC (minutes): 25.41

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
E1	2.28	0.67	0.71	78.450	0	00:10:00
E2	2.28	0.67	0.31	78.450	0	00:10:00
E3	2.28	0.67	0.34	78.450	0	00:10:00
E4	2.28	0.67	0.33	78.450	0	00:10:00
E5	2.28	0.67	0.27	78.450	0	00:10:00
E6	2.28	0.67	0.17	78.450	0	00:10:00
E7	2.28	0.67	0.23	78.450	0	00:10:00
W1	2.28	0.67	0.75	78.450	0	00:25:24

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
32327-038	0.06	0.25	69.00	0	12:25	0	0	0:00:00
I1-1	0.00	0.00	72.08	0	00:00	0	0	0:00:00
I1-2	0.10	0.40	67.87	0	12:15	0	0	0:00:00
I2-1	0.07	0.26	63.49	0	12:15	0	0	0:00:00
I2-2	0.06	0.26	63.50	0	12:14	0	0	0:00:00
I2-3	0.07	0.27	63.61	0	12:15	0	0	0:00:00
I2-4	0.05	0.25	63.59	0	12:14	0	0	0:00:00
I3-1	0.07	0.26	61.09	0	12:15	0	0	0:00:00
I3-2	0.06	0.25	61.08	0	12:13	0	0	0:00:00
S1-1	0.00	0.00	70.80	0	00:00	0	0	0:00:00
S1-2	0.09	0.37	66.57	0	12:15	0	0	0:00:00
S2-1	0.13	0.50	62.47	0	12:15	0	0	0:00:00
S2-2	0.13	0.48	62.06	0	12:16	0	0	0:00:00
S2-3	0.15	0.61	61.56	0	12:16	0	0	0:00:00
S3-1	0.15	0.62	60.89	0	12:18	0	0	0:00:00
S3-2	0.15	0.64	60.65	0	12:18	0	0	0:00:00
S3-3	0.17	0.68	60.15	0	12:18	0	0	0:00:00
32327-037	0.06	0.24	65.71	0	12:25	0	0	0:00:00
32327-174	0.00	0.00	58.22	0	00:00	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm

32327-038	JUNCTION	0.75	0.75	0	12:25	0.00
I1-1	JUNCTION	0.00	0.00	0	00:00	0.00
I1-2	JUNCTION	0.71	0.71	0	12:15	0.00
I2-1	JUNCTION	0.31	0.31	0	12:15	0.00
I2-2	JUNCTION	0.27	0.27	0	12:15	0.00
I2-3	JUNCTION	0.34	0.34	0	12:15	0.00
I2-4	JUNCTION	0.16	0.16	0	12:15	0.00
I3-1	JUNCTION	0.32	0.32	0	12:15	0.00
I3-2	JUNCTION	0.23	0.23	0	12:15	0.00
S1-1	JUNCTION	0.00	0.00	0	00:00	0.00
S1-2	JUNCTION	0.00	0.70	0	12:15	0.00
S2-1	JUNCTION	0.00	1.38	0	12:15	0.00
S2-2	JUNCTION	0.00	1.24	0	12:15	0.00
S2-3	JUNCTION	0.00	1.76	0	12:16	0.00
S3-1	JUNCTION	0.00	1.69	0	12:16	0.00
S3-2	JUNCTION	0.00	1.69	0	12:16	0.00
S3-3	JUNCTION	0.00	2.09	0	12:15	0.00
32327-037	OUTFALL	0.00	0.75	0	12:25	0.00
32327-174	OUTFALL	0.00	2.11	0	12:17	0.00

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
32327-037	62.33	0.14	0.75
32327-174	62.16	0.29	2.11
System	62.24	0.42	2.79

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time minutes	Reported Condition
14869	CONDUIT	0 12:25	5.09	1.00	0.75	6.04	0.12	0.24	0	Calculated
P1-1	CONDUIT	0 00:00	0.00	1.00	0.00	5.48	0.00	0.00	0	Calculated
P1-2	CONDUIT	0 00:00	0.00	1.00	0.00	14.86	0.00	0.09	0	Calculated
P1-3	CONDUIT	0 12:15	3.23	1.00	0.70	5.49	0.13	0.32	0	Calculated
P1-4	CONDUIT	0 12:15	2.37	1.00	0.79	16.03	0.05	0.26	0	Calculated
P2-1	CONDUIT	0 12:15	2.57	1.00	0.30	5.50	0.06	0.21	0	Calculated
P2-2	CONDUIT	0 12:14	2.55	1.00	0.30	5.46	0.05			

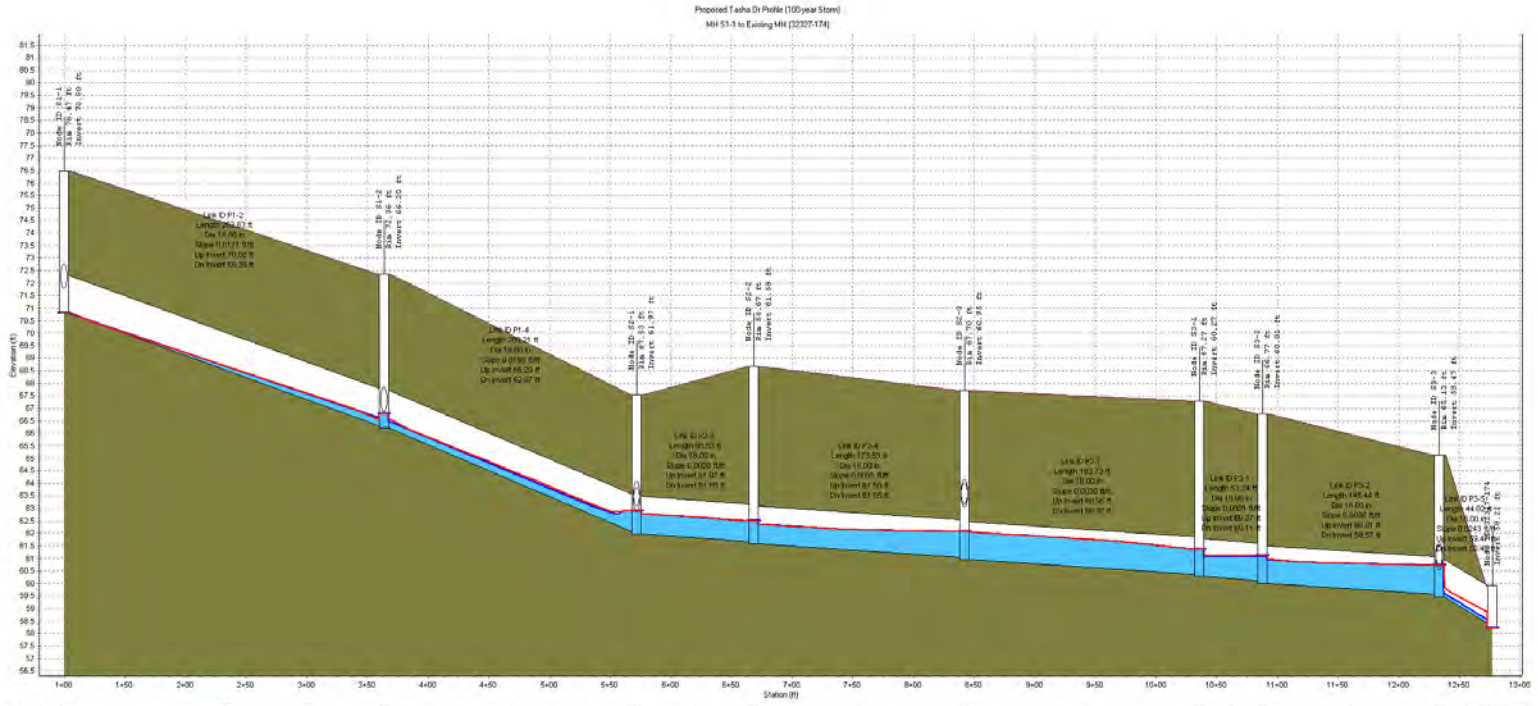
0.21	0	Calculated							
P2-3		CONDUIT	0	12:15	2.73	1.00	1.24	6.23	0.20
0.30	0	Calculated							
P2-4		CONDUIT	0	12:16	2.57	1.00	1.23	6.29	0.20
0.33	0	Calculated							
P2-5		CONDUIT	0	12:15	2.62	1.00	0.33	5.46	0.06
0.22	0	Calculated							
P2-6		CONDUIT	0	12:14	2.25	1.00	0.22	5.46	0.04
0.18	0	Calculated							
P2-7		CONDUIT	0	12:16	2.94	1.00	1.69	6.23	0.27
0.38	0	Calculated							
P3-1		CONDUIT	0	12:16	2.87	1.00	1.69	6.30	0.27
0.38	0	Calculated							
P3-2		CONDUIT	0	12:22	2.61	1.00	1.66	6.26	0.27
0.41	0	Calculated							
P3-3		CONDUIT	0	12:15	2.60	1.00	0.32	5.46	0.06
0.22	0	Calculated							
P3-4		CONDUIT	0	12:15	2.53	1.00	0.29	5.46	0.05
0.20	0	Calculated							
P3-5		CONDUIT	0	12:17	3.96	1.00	2.11	17.74	0.12
0.34	0	Calculated							

```
  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link P3-5 (3)
  Link P2-2 (2)
  Link P1-3 (2)
  Link P2-1 (1)
  Link P3-4 (1)


  Analysis began on:  Wed Oct 26 21:54:35 2022
  Analysis ended on:  Wed Oct 26 21:54:37 2022
  Total elapsed time: 00:00:02
```

PROPOSED CONDITIONS

TASHA DR. SYSTEM (100-YEAR STORM)
MH S1-1 TO MH 32327-174



Node ID:	S1-1		S1-2		S2-1	S2-2	S2-3		S3-1	S3-2		S3-3	32327-174
Rim (ft)	76.47		72.36		67.53	68.67	67.70		67.27	66.77		65.13	
Invert (ft)	70.00		66.20		61.97	61.68	60.95		60.27	60.01		59.47	58.22
Min Pipe Cover (ft)	3.72		4.52		3.45	5.49	3.55		5.40	5.18		3.49	
Max HGL (ft)	70.00		66.00		62.91	62.52	62.10		61.41	61.15		60.80	58.22
Link ID:	P1-2	P1-4		P2-3	P2-4	P2-7		P3-1	P3-2		P3-5		
Length (ft)	263.83	208.21		96.53	173.53	193.73		52.24	145.44		44.02		
Dia (in)	18.00	18.00		18.00	18.00	18.00		18.00	18.00		18.00		
Slope (ft/ft)	0.0171	0.0138		0.0030	0.0031	0.0030		0.0031	0.0030		0.0243		
Up Invert (ft)	70.00	66.20		61.97	61.68	60.95		60.27	60.01		59.47		
Dn Invert (ft)	66.30	62.07		61.68	61.05	60.37		60.11	59.57		58.40		
Max Q (cfs)	0.00	1.68		3.00	2.98	4.10		4.08	4.08		5.26		
Max Vel (ft/s)	0.00	2.38		2.99	2.59	2.98		2.98	2.72		4.52		
Max Depth (ft)	0.24	0.70		0.86	0.97	1.56		1.03	1.13		0.96		

Autodesk Storm and Sanitary Analysis

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... 10150.00 Proposed Conditions_SSA Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date OCT-26-2022 00:00:00
Ending Date OCT-27-2022 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 8
Number of nodes 19
Number of links 17

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Tasha_Drive	100-year, 24-hour Design Storm Event	CUMULATIVE	6.00

****
Subbasin Summary
****

Subbasin ID	Total Area acres
E1	1.74
E2	0.75
E3	0.82
E4	0.80
E5	0.67
E6	0.40
E7	0.57
W1	2.81

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
32327-038	JUNCTION	68.75	73.26	0.00	

I1-1	JUNCTION	72.08	76.92	0.00
I1-2	JUNCTION	67.47	72.55	0.00
I2-1	JUNCTION	63.23	68.66	0.00
I2-2	JUNCTION	63.24	68.05	0.00
I2-3	JUNCTION	63.34	67.46	0.00
I2-4	JUNCTION	63.34	67.18	0.00
I3-1	JUNCTION	60.83	65.36	0.00
I3-2	JUNCTION	60.83	64.81	0.00
S1-1	JUNCTION	70.80	76.47	0.00
S1-2	JUNCTION	66.20	72.36	0.00
S2-1	JUNCTION	61.97	67.53	0.00
S2-2	JUNCTION	61.58	68.67	0.00
S2-3	JUNCTION	60.95	67.70	0.00
S3-1	JUNCTION	60.27	67.27	0.00
S3-2	JUNCTION	60.01	66.77	0.00
S3-3	JUNCTION	59.47	65.13	0.00
32327-037	OUTFALL	65.47	66.47	0.00
32327-174	OUTFALL	58.22	59.90	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
14869	32327-038	32327-037	CONDUIT	33.5	9.7823	0.0240
P1-1	I1-1	S1-1	CONDUIT	16.4	2.0159	0.0120
P1-2	S1-1	S1-2	CONDUIT	263.8	1.7056	0.0120
P1-3	I1-2	S1-2	CONDUIT	31.1	2.0262	0.0120
P1-4	S1-2	S2-1	CONDUIT	208.2	1.9836	0.0120
P2-1	I2-1	S2-1	CONDUIT	20.2	2.0291	0.0120
P2-2	I2-2	S2-1	CONDUIT	8.0	2.0000	0.0120
P2-3	S2-1	S2-2	CONDUIT	96.5	0.3000	0.0120
P2-4	S2-2	S2-3	CONDUIT	173.5	0.3054	0.0120
P2-5	I2-3	S2-3	CONDUIT	15.5	2.0000	0.0120
P2-6	I2-4	S2-3	CONDUIT	9.5	2.0000	0.0120
P2-7	S2-3	S3-1	CONDUIT	193.7	0.2994	0.0120
P3-1	S3-1	S3-2	CONDUIT	52.2	0.3063	0.0120
P3-2	S3-2	S3-3	CONDUIT	145.4	0.3025	0.0120
P3-3	I3-1	S3-3	CONDUIT	15.5	2.0000	0.0120
P3-4	I3-2	S3-3	CONDUIT	9.5	2.0000	0.0120
P3-5	S3-3	32327-174	CONDUIT	44.0	2.4305	0.0120

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
14869	CIRCULAR	1.00	1.00	1	0.79	0.25	6.04
P1-1	CIRCULAR	1.00	1.00	1	0.79	0.25	5.48
P1-2	CIRCULAR	1.50	1.50	1	1.77	0.38	14.86
P1-3	CIRCULAR	1.00	1.00	1	0.79	0.25	5.49

P1-4	CIRCULAR	1.50	1.50	1	1.77	0.38
16.03						
P2-1	CIRCULAR	1.00	1.00	1	0.79	0.25
5.50						
P2-2	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P2-3	CIRCULAR	1.50	1.50	1	1.77	0.38
6.23						
P2-4	CIRCULAR	1.50	1.50	1	1.77	0.38
6.29						
P2-5	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P2-6	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P2-7	CIRCULAR	1.50	1.50	1	1.77	0.38
6.23						
P3-1	CIRCULAR	1.50	1.50	1	1.77	0.38
6.30						
P3-2	CIRCULAR	1.50	1.50	1	1.77	0.38
6.26						
P3-3	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P3-4	CIRCULAR	1.00	1.00	1	0.79	0.25
5.46						
P3-5	CIRCULAR	1.50	1.50	1	1.77	0.38
17.74						

*************************	Volume	Depth
Runoff Quantity Continuity	acre-ft	inches
*************************	---------	-------
Total Precipitation	2.561	3.596
Surface Runoff	0.019	0.026
Continuity Error (%)	-0.001	

*************************	Volume	Volume
Flow Routing Continuity	acre-ft	Mgallons
*************************	---------	---------
External Inflow	0.000	0.000
External Outflow	1.140	0.371
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.004	0.001
Continuity Error (%)	-0.013	

****
Composite Curve Number Computations Report
****

Subbasin E1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	1.48	B	75.00
Paved roads with curbs & sewers	0.26	B	98.00
Composite Area & Weighted CN	1.74		78.45

Subbasin E2

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.63	B	75.00

Paved roads with curbs & sewers	0.11	B	98.00
Composite Area & Weighted CN	0.75		78.45

Subbasin E3

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.70	B	75.00
Paved roads with curbs & sewers	0.12	B	98.00
Composite Area & Weighted CN	0.82		78.45

Subbasin E4

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.68	B	75.00
Paved roads with curbs & sewers	0.12	B	98.00
Composite Area & Weighted CN	0.79		78.45

Subbasin E5

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.57	B	75.00
Paved roads with curbs & sewers	0.10	B	98.00
Composite Area & Weighted CN	0.67		78.45

Subbasin E6

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.34	B	75.00
Paved roads with curbs & sewers	0.06	B	98.00
Composite Area & Weighted CN	0.40		78.45

Subbasin E7

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	0.48	B	75.00
Paved roads with curbs & sewers	0.09	B	98.00
Composite Area & Weighted CN	0.57		78.45

Subbasin W1

Soil/Surface Description	Area (acres)	Soil Group	CN
1/4 acre lots, 38% impervious	2.39	B	75.00
Paved roads with curbs & sewers	0.42	B	98.00
Composite Area & Weighted CN	2.81		78.45

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin E1

User-Defined TOC override (minutes): 10.00

Subbasin E2

User-Defined TOC override (minutes): 10.00

Subbasin E3

User-Defined TOC override (minutes): 10.00

Subbasin E4

User-Defined TOC override (minutes): 10.00

Subbasin E5

User-Defined TOC override (minutes): 10.00

Subbasin E6

User-Defined TOC override (minutes): 10.00

Subbasin E7

User-Defined TOC override (minutes): 10.00

Subbasin W1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	75.00	0.00	0.00
Slope (%):	3.51	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.40	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	20.59	0.00	0.00

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.01	0.00	0.00
Flow Length (ft):	736.00	0.00	0.00
Channel Slope (%):	1.00	0.00	0.00
Cross Section Area (ft²):	1.05	0.00	0.00
Wetted Perimeter (ft):	10.02	0.00	0.00
Velocity (ft/sec):	2.55	0.00	0.00
Computed Flow Time (minutes):	4.82	0.00	0.00

Total TOC (minutes): 25.41

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
E1	3.59	1.60	1.81	78.450	0	00:10:00
E2	3.59	1.60	0.78	78.450	0	00:10:00
E3	3.59	1.60	0.86	78.450	0	00:10:00
E4	3.59	1.60	0.83	78.450	0	00:10:00
E5	3.59	1.60	0.70	78.450	0	00:10:00
E6	3.59	1.60	0.42	78.450	0	00:10:00
E7	3.59	1.60	0.60	78.450	0	00:10:00
W1	3.59	1.60	1.93	78.450	0	00:25:24

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
32327-038	0.11	0.41	69.16	0	12:25	0	0	0:00:00
I1-1	0.00	0.00	72.08	0	00:00	0	0	0:00:00
I1-2	0.19	0.85	68.32	0	12:15	0	0	0:00:00
I2-1	0.12	0.46	63.69	0	12:15	0	0	0:00:00
I2-2	0.11	0.40	63.64	0	12:15	0	0	0:00:00
I2-3	0.13	0.49	63.83	0	12:14	0	0	0:00:00
I2-4	0.09	0.30	63.64	0	12:15	0	0	0:00:00
I3-1	0.13	0.49	61.32	0	12:14	0	0	0:00:00
I3-2	0.11	0.36	61.19	0	12:15	0	0	0:00:00
S1-1	0.00	0.00	70.80	0	00:00	0	0	0:00:00
S1-2	0.17	0.60	66.80	0	12:16	0	0	0:00:00
S2-1	0.24	0.94	62.91	0	12:16	0	0	0:00:00
S2-2	0.24	0.94	62.52	0	12:16	0	0	0:00:00
S2-3	0.27	1.15	62.10	0	12:16	0	0	0:00:00
S3-1	0.28	1.14	61.41	0	12:17	0	0	0:00:00
S3-2	0.27	1.14	61.15	0	12:17	0	0	0:00:00
S3-3	0.30	1.33	60.80	0	12:17	0	0	0:00:00
32327-037	0.11	0.39	65.86	0	12:25	0	0	0:00:00
32327-174	0.00	0.00	58.22	0	00:00	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm

32327-038	JUNCTION	1.91	1.91	0	12:24	0.00
I1-1	JUNCTION	0.00	0.00	0	00:00	0.00
I1-2	JUNCTION	1.79	1.79	0	12:15	0.00
I2-1	JUNCTION	0.77	0.77	0	12:15	0.00
I2-2	JUNCTION	0.69	0.69	0	12:15	0.00
I2-3	JUNCTION	0.85	0.85	0	12:15	0.00
I2-4	JUNCTION	0.42	0.42	0	12:15	0.00
I3-1	JUNCTION	0.82	0.82	0	12:15	0.00
I3-2	JUNCTION	0.59	0.59	0	12:15	0.00
S1-1	JUNCTION	0.00	0.00	0	00:00	0.00
S1-2	JUNCTION	0.00	1.77	0	12:15	0.00
S2-1	JUNCTION	0.00	3.13	0	12:14	0.00
S2-2	JUNCTION	0.00	3.00	0	12:16	0.00
S2-3	JUNCTION	0.00	4.19	0	12:15	0.00
S3-1	JUNCTION	0.00	4.10	0	12:16	0.00
S3-2	JUNCTION	0.00	4.09	0	12:17	0.00
S3-3	JUNCTION	0.00	5.34	0	12:16	0.00
32327-037	OUTFALL	0.00	1.91	0	12:25	0.00
32327-174	OUTFALL	0.00	5.26	0	12:17	0.00

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
32327-037	75.21	0.35	1.91
32327-174	75.01	0.78	5.26
System	75.11	1.13	6.98

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time minutes	Reported Condition
14869	CONDUIT	0 12:25	6.50	1.00	1.91	6.04	0.32	0.40	0	Calculated
P1-1	CONDUIT	0 00:00	0.00	1.00	0.00	5.48	0.00	0.00	0	Calculated
P1-2	CONDUIT	0 00:00	0.00	1.00	0.00	14.86	0.00	0.17	0	Calculated
P1-3	CONDUIT	0 12:15	3.50	1.00	1.77	5.49	0.32	0.62	0	Calculated
P1-4	CONDUIT	0 12:14	2.39	1.00	1.68	16.03	0.10	0.48	0	Calculated
P2-1	CONDUIT	0 12:15	3.26	1.00	0.77	5.50	0.14	0.35	0	Calculated
P2-2	CONDUIT	0 12:15	3.20	1.00	0.68	5.46	0.13			

0.32	0	Calculated							
P2-3		CONDUIT	0	12:16	2.99	1.00	3.00	6.23	0.48
0.59	0	Calculated							
P2-4		CONDUIT	0	12:16	2.58	1.00	2.98	6.29	0.47
0.66	0	Calculated							
P2-5		CONDUIT	0	12:14	3.26	1.00	0.88	5.46	0.16
0.38	0	Calculated							
P2-6		CONDUIT	0	12:15	2.79	1.00	0.42	5.46	0.08
0.24	0	Calculated							
P2-7		CONDUIT	0	12:16	2.98	1.00	4.10	6.23	0.66
0.73	0	Calculated							
P3-1		CONDUIT	0	12:17	2.98	1.00	4.09	6.30	0.65
0.73	0	Calculated							
P3-2		CONDUIT	0	12:17	2.72	1.00	4.08	6.26	0.65
0.79	0	Calculated							
P3-3		CONDUIT	0	12:14	3.26	1.00	0.87	5.46	0.16
0.38	0	Calculated							
P3-4		CONDUIT	0	12:15	3.06	1.00	0.59	5.46	0.11
0.29	0	Calculated							
P3-5		CONDUIT	0	12:17	4.52	1.00	5.26	17.74	0.30
0.63	0	Calculated							

```
  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link P3-5 (26)
  Link P1-3 (14)
  Link P2-7 (11)
  Link P3-1 (9)
  Link P3-2 (7)


  Analysis began on:  Wed Oct 26 21:55:46 2022
  Analysis ended on:  Wed Oct 26 21:55:49 2022
  Total elapsed time: 00:00:03
```

Draft DSM Review Comments and Responses

Appendix L

Tasha Drive Reconstruction

MOA / PM&E Project No. 20-15

Review Comments Summary

DSM and 35% Submittal						
No.	**Reviewer**	**Date**	**Com. No.**	**Sheet No. / Page No.**	**Comment**	**Response**
1	PME Survey Donna Brechan	11/16/2022	1	N/A	No Comments at this time	Thank you.
2	MOA Addressing Karleen Wilson	11/16/2022	1	N/A	No Comments at this time	Thank you.
3	MOA ROW Martha Robinson	11/16/2022	1	All	Missing Easement and Permit Index Map for parcel acquisitions, if needed.	will include at 65%
4	PM&E Isobel Roy	11/16/202	1	S sheets	Will await 65% submittal to review any tree/sign conflicts. In the meantime, consider a note to signing sheets something to the effect that "Once signs are in place, contractor shall prune trees as directed by the engineer to make signs visible for traffic and in accordance with the American National Standard (ANSI) A300, Part 1, Standard Practices Pruning and ANSI Z133.1 Arboricultural Operations Safety. Pruning trees is incidental to the project and no separate payment shall be made." This aims to protect tree health in those cases where sign location cannot be easily field adjusted.	Note added to all S sheets.
5	MOA ROW Michael Walters	11/16/2022	1	General	All plans submitted for review shall be complete and ready for construction prior to approval by this Department. This includes that all plans and details be stamped and signed by an Engineer registered in the State of Alaska to practice stated work.	Will submit final plans for approval.
6	MOA ROW Michael Walters	11/16/2022	2	General	Right Permit is required for all work of Way	Contractor is required to obtain all permits.
7	MOA ROW Michael Walters	11/16/2022	3	D-1	1) Typical- Change Landing Running Slope to 1.5%	Changed landing running slope to 1.5%
8	MOA ROW Michael Walters	11/16/2022	4	D-1	2) Change Max Landing to 1.5%	Changed max landing slope to 1.5%
9	MOA ROW Michael Walters	11/16/2022	5	Sheet 12	Note 9: Add do not install j-boxes on slopes.	Will add note to not install j-boxes on slopes.
10	Steven Parkinson Street Maintenance	11/17/2022	1	I1	Add note: All conduit and fittings shall be hot dip galvanized, reference MASS 80.07.1.	Will do
11	Steven Parkinson Street Maintenance	11/17/2022	2	I1/ G3	Add to I1 or on G3, Note 1 referencing National Electric Code is 2017 Edition and the amendments adopted in AMC 23.30.	Will do
12	Steven Parkinson Street Maintenance	11/17/2022	3	I1	Is placement of LC near proposed L2 location possible? This would facilitate possible future MOA lighting of Kathleen, Flamingo and Lyvona from this LC	Final location of load center will be coordinated with CEA and we will work to provide in a location that would facilitate future MOA lighting of Kathleen, Flamingo and Lyvona.
13	Steven Parkinson Street Maintenance	11/17/2022	4	I3	Detail A, add galvanized fitting note. All conduit and fittings shall be hot dip galvanized, reference MASS 80.07.1.	Will do

Tasha Drive Reconstruction
MOA / PM&E Project No. 20-15
Review Comments Summary

DSM and 35% Submittal						
No.	**Reviewer**	**Date**	**Com. No.**	**Sheet No. / Page No.**	**Comment**	**Response**
14	Steven Parkinson Street Maintenance	11/17/2022	5	I4	Update Detail 2, Control Schematic: Consider using updated HOA detail: (see detail on "electrical detail example" tab)	Will change Detail 2 to match "electrical detail example" tab provided.
15	Steven Parkinson Street Maintenance	11/17/2022	6	I4	Panel Schedule, 2 pole simultaneous breaker illustrations	Will coordinate with Street Maintenance to clarify and address this comment.
16	Steven Parkinson Street Maintenance	11/17/2022	7	D4	Roadway Luminaire Clearing Detail: The road side edge of clearing limits extends up from the outside edge of curb illustration. There is a dimension from the road side edge of the clearing limit to the road side edge of the luminaire indicating 2.0'. This gives the appearance the luminaire should be 2' from edge of curb. I understand this is not what is being illustrated here, but there is potential for the dimension to be misinterpreted.	Will correct and clarify at 65% design
17	Rebecca Carrol	11/22/2022	1	General	Tasha Drive does not meet a current MOA standard street width. Please consider narrowing the street width to 31 ft to comply with DCM Table 1-6 (for ADT of 0-300) and reconsider adding a sidewalk on one side of the street.	We considered narrowing the street per DCM Table 1-6, however location of existing sewer manhole and water valves would result in surface features within the proposed curbline. For this reason we propose to keep the street width at 33 feet.
18	Rebecca Carrol	11/22/2022	2	General	AMC 21.07.060E.2 requires a sidewalk on both sides of the street. Submit a design variance if a sidewalk will only be provided on one side or neither side.	Will submit a design variance for no sidewalks.
19	Rebecca Carrol	11/22/2022	3	DSM pg 5	A traffic volume study was conducted 150 ft west of Northwood Street. Please consider doing a traffic volume study on the section of Tasha Drive between Flamingo Dr and Kathleen Dr (this section seems likely to get more traffic flow) or assess traffic volume in accordance with the ITE Trip Generation Manual.	additional data was not able to be gathered due to CEA not allowing even temporary devices (e.g. data gathering infrastructure) on their poles. Additional data was generated and analyzed in accordance with the ITE Trip Generation Manual and is included in the text and appendix.
20	Rebecca Carrol	11/22/2022	4	Appendix F	Please provide additional traffic study data to substantiate traffic volume utilized for design.	Additional data was generated and added to Appendix F.

Tasha Drive Reconstruction
MOA / PM&E Project No. 20-15
Review Comments Summary

DSM and 35% Submittal						
No.	**Reviewer**	**Date**	**Com. No.**	**Sheet No. / Page No.**	**Comment**	**Response**
21	Rebecca Carrol	11/22/2022	5	DSM pg 20	Regarding DSM Section 9.1.3 Water Quality Treatment, please address whether an assessment of the existing OGS and vegetated swale was completed to verify the existing infrastructure is providing adequate water quality treatment.	An assessment of the existing OGS and swale was not completed due to expedited project schedule (and now winter conditions). CRW will contact Street Maintenance during the design phase to verify that adequate treatment is being provided. If this is not the case, CRW will include a new OGS and bypass system prior to connecting to the system on Northwood Street. Additional language has been added to Section 9.1.3 of the DSM to cover our approach.
22	Rebecca Carrol	11/22/2022	6	DSM pg 25	DSM states that a variance to AMC Title 21 will be required for the proposed Type 2 rolled curb and gutter. It seems this project would fall under the exception (AMC 21.08.050G.1.b).	Removed variance language in DSM. Title 21 allows for rolled curb in residential minor streets.
23	Rebecca Carrol	11/22/2022	7	C1 & D2	Detail 2/D2 Board Insulation & Excavation Transition to a side street shows a transition to a shallower structural section for the side street. Typical Section 2/C1 for Kathleen Drive references the same structural section as Tasha Drive. Please clarify.	Will review and update at the 65% design
24	Rebecca Carrol	11/22/2022	8	SD2 & SD3	Portions of the proposed storm drain system are less than 10 ft from existing water piping (18 AAC 72.020 & ASM Vol 1 Table 6.4-1). This includes structures S2-1, I2-1 and I2-2 on Sheet SD2 and structure S3-1 on Sheet SD3. Please address.	Plan to revise the low point near Station 5+60 for 65% design. This will provide more separation from the storm drain structures and water lines. Will review relocating structure S3-1, however, we may need to request a DEC waiver for this location.
25	Rebecca Carrol	11/22/2022	9	SD4	Detail 1/SD4 depicts a water pipe running parallel to the subdrain, which requires a 10 ft separation or a waiver from ADEC. If the intent was to depict a crossing, please clarify and extend insulation a minimum 2 ft beyond each side of pipe, in accordance with MASS standard detail 60-02.	Will revise detail at 65% design.
26	Zach Johnson Street Maintenance	11/22/2022	1	R1-R6	Add insulation to plan & profile where required.	Will add to the 65% design
27	Zach Johnson Street Maintenance	11/23/2022	2		Add Curb Ramps to plan & profile. Add curb ramp summary & table.	Will add to the 65% design