IMAGE DRIVE / REFLECTION DRIVE AREA

Road Reconstruction

DRAFT DESIGN STUDY REPORT

DECEMBER 2017

MOA Project No. 14-50

Prepared for:

Municipality of Anchorage
Project Management &
Engineering Department
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Executive Summary

1. Overview

The Municipality of Anchorage Project Management and Engineering Department (MOA PM&E) has contracted with CRW Engineering Group, LLC to provide professional services to evaluate alternatives to upgrade the Image Drive/Reflection Drive area. The project area includes Image Drive, Reflection Drive, a portion of Defiance Street, and the associated cul-de-sacs of Mirage Circle, Keyann Circle, Image Circle, Ridgelake Circle, and Loon Cove Circle.

The majority of the roadways in the project area were constructed in the 1980s and have reached the end of their useful life. High ground water and soil conditions have resulted in corroded and failing storm drain pipes throughout the project limits. Additionally, the existing Image Drive storm drain system outfalls into a stream with a submerged outlet and the stream backs up into the existing storm drain system.

Stakeholder comments were solicited using the Context Sensitive Solutions (CSS) process through the following venues:

- Project Website
- Resident/Owner Questionnaire
- Direct Mailings and Electronic Mailings to Residents/Owners
- University Area Community Council Meeting
- Community Open House Meeting
- Agency Coordination Meetings

Based on public and agency stakeholder input received, the primary goals of this project are as follows:

- Reconstruct the roadways and provide a stable roadway base to extend the life of the streets;
- Improve drainage and replace the failing storm drain system;
- Alleviate maintenance issues;
- Upgrade pedestrian facilities to meet current requirements;
- Minimize impacts to adjacent properties.

2. Recommended Improvements

In order to achieve the project goals, the recommended project improvements include the following:

A. Roadway Cross Section

The roadway cross-section for Image Drive, Reflection Drive and Defiance Street includes two 11-foot lanes, one 7-foot parking lane (33 feet total width back of curb to back of curb), and one attached 5-foot sidewalk. The project plans to remove and replace sidewalks in existing locations only except for two additional new locations: a new sidewalk is proposed on the north side of Image Drive from Reflection Drive to Mirage Circle (north) and on the east side of Image Drive from Reflection Drive to Ridgelake Circle.

For the cul-de-sacs at the neck, the roadway cross-section includes two 10-foot lanes, one 7-foot parking lane (31 feet total width back of curb to back of curb) and 5-foot sidewalks will only be installed on Ridgelake Circle. The cul-de-sac bulbs will typically match the existing radii except for at Ridgelake Circle where the proposed back of curb will be narrowed by 1 foot in order to install the proposed 5-foot sidewalk. No lane striping is proposed on any of the roadways. Due to the existing dense layout of the driveways in the project area, Type 2 rolled curb is proposed. Where feasible, Type 1 barrier curb will be installed where there is an absence of driveways.

B. Roadway Horizontal and Vertical Alignment

The project roadways will typically follow the center of the right-of-way. The proposed preferred profile for Image Drive and Reflection Drive will force high/low spots by raising the grades to a minimum of 0.65%.

C. Posted Speed Limit

It is proposed that the posted speed limit for Image Drive and Reflection Drive remain at 25 mph.

D. Traffic Calming

The existing 4 speed humps along Reflection Drive and Image Drive are recommended to be re-installed as part of this project.

E. Drainage

The proposed drainage improvements include replacing manholes, catch basins and storm drain pipe with CPEP perforated pipe (subdrain) throughout the project limits. Dual subdrains will only be installed where feasible. A below grade detention system will be installed within the dead end road of Mirage Circle (north). An oil and grit separator will be installed prior to the lift station for water quality. The existing sedimentation basin will be replaced with a detention basin and the outfall pipe from the basin replaced. Footing drain service stub-outs will be provided to all residents in the project area where a proposed storm drain is installed adjacent to the parcel. In order to construct the improvements, the existing Reflection Drive and Image Drive culverts will be removed and replaced with the same size culverts and stream substrate.

F. Stormwater Lift Station

In order for the proposed subdrains to be located beneath the proposed structural section, the subdrain pipes will need to be installed lower than the existing Image Drive/Reflection Drive storm drain outfall elevations. Therefore, the installation of a stormwater lift station is recommended. The installation of a lift station will also alleviate the existing submerged storm drain outfall from the Image Drive storm drain system. The proposed lift station will be located at the northeast corner of Reflection Drive/Image Drive and will discharge into the proposed detention basin north of the lift station.

G. Heat Trace

Heat trace will be re-installed within the existing Reflection Lake Creek culverts and at the inlet/outlet of the culverts. New heat trace will also be installed at the force main outfall, along the detention basin and in the pipe that outfalls from the detention basin to the existing storm drain system.

H. Lighting

A continuous roadway LED lighting system, current with MOA standards is proposed.

I. Landscaping

The proposed landscaping will be minimal; the focus will be on preserving existing vegetation to the greatest extent practical, supplementing the existing landscaping with new plantings when appropriate.

The MOA may choose to phase the construction of this project in order to coincide with funding requests and to minimize impacts to the entire neighborhood.

Following is a summary of the estimated project costs for the recommended improvements:

Category	Cost
Design & Management Total (estimated)	$2,338,000
ROW Acquisition Total	$110,000
Utility Relocation (10% Contingency) Total	$661,000
A. Design, ROW Acquisition, Utility Relocation	***$3,109,000***
Construction Roadway Improvements	$4,288,000
Drainage Improvements	$3,363,000
Illumination Improvements	$493,000
Water Improvements	$159,000
Construction Subtotal	*$8,303,000*
Construction Contingency (15%)	$1,246,000
Construction Management / Inspection / Testing	$681,000
B. Total Estimated Construction Cost (rounded)	***$10,230,000***
C. Overhead / Grant Accounting	***$2,354,000***
Total Estimated Project Cost (A + B + C)	***$15,693,000***

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1. Introduction

The Municipality of Anchorage Project Management and Engineering (MOA PM&E) has contracted with CRW Engineering Group, LLC to provide professional services to evaluate alternatives to upgrade the Image Drive/Reflection Drive area. The project area is located north of Tudor Road and east of Boniface Parkway, see FIGURE 1 for project location and vicinity map. The project area includes Image Drive, Reflection Drive, a portion of Defiance Street, and the associated cul-de-sacs of Mirage Circle, Keyann Circle, Image Circle, Ridgelake Circle, and Loon Cove Circle.

A. Project Purpose and Goals

The majority of roadways in the project area were constructed in the 1980s and have reached the end of their useful life. Ponding along the project roadways and curbs, as shown in the photo below, are normal occurrences after rain events. High ground water and soil conditions have resulted in corroded and failing storm drain pipes throughout the project limits. Road conditions include moderate frost cracking and persistent transverse cracks in the pavement. Additionally, the existing Image Drive storm drain system outfalls into a stream with a submerged outlet and during storm events the stream backs up into the existing storm drain system. The purpose of the project is to reconstruct the roadways and associated failing storm drain system, improve drainage, alleviate maintenance issues, upgrade pedestrian facilities to meet current requirements, and provide a stable roadway base to extend the life of the streets.

Reflection Drive at Image Drive intersection (north) viewing south

B. Project Approach

Prior to beginning this Design Study Report (DSR), the project team met with key agency stakeholders to ensure the recommended alternative would meet the needs and requirements of all. A meeting was held with MOA PM&E, MOA Traffic Department (Traffic), and MOA Street Maintenance (Maintenance) in October 2016 to discuss the existing conditions, preliminary traffic analysis, proposed roadway design elements, and project area challenges. Input and comments received from the Resident/Owner Questionnaire was included in the discussions to balance the needs of Maintenance, Traffic, PM&E, and the residents.

Following the meeting, CRW prepared a Draft Technical Memorandum (Tech Memo) that outlined significant elements of the design for review, concurrence, and approval by PM&E, Traffic, and Maintenance. Review comments were incorporated and the Final Tech Memo was submitted to and approved by MOA PM&E on November 30th, 2016. The full Tech Memo including the responses from the Resident/Owner Questionnaire can be found in APPENDIX A.

C. Evaluation Factors

This Design Study Report considers the following factors during the evaluation of needed improvements for the Image Drive / Reflection Drive Area Road Reconstruction.

- Resident/Agency Input and Needs
- Area Drainage Patterns
- Traffic and Pedestrian Accident History
- Vehicle Speeds
- Previous Planning & Design Documents
- Neighborhood Connectivity
- Existing Soil Conditions
- Environmental Impacts
- Right-of-Way Restrictions
- Adjacent Neighborhood and Property Owner Impacts
- Emergency Access
- Utility Relocation Requirements
- Maintenance Requirements

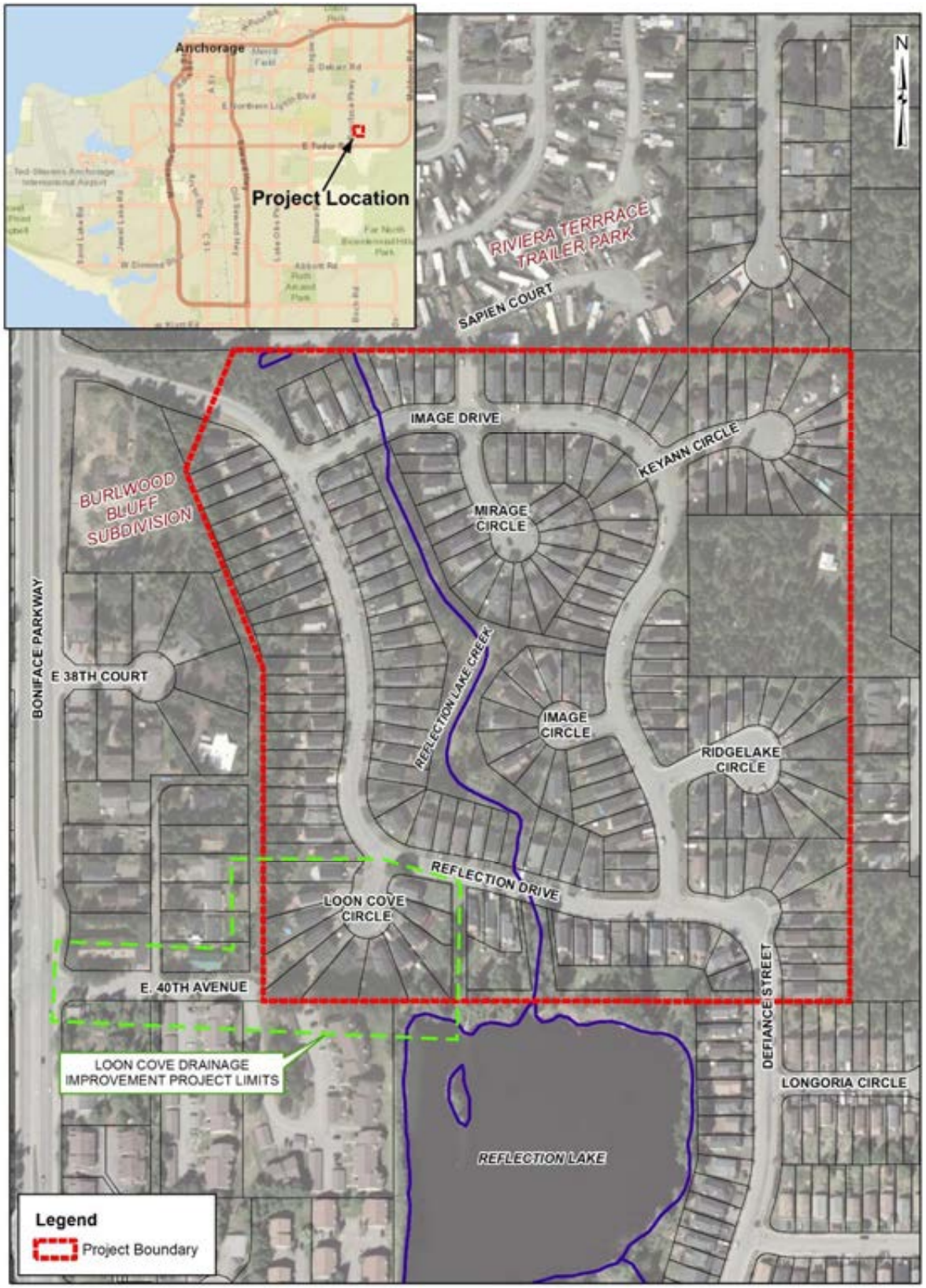


Figure 1 - Project Location and Vicinity Map

2. Existing Conditions

A. Community Context

1. Area Context

The project area encompasses 196 single family homes with lots typically 4,500 square feet or less. The lots have all been developed excluding one 2.5-acre lot south of Keyann Circle that hasn't been subdivided yet, but does have a single family home on the lot. The primary streets in the subdivision were platted in several phases from 1984 through 1986. Roadway construction was substantially completed by 1988, but only a few homes had been built by that time (as seen on the photo to the right). Most of the homes were constructed between 1991 and 1995.

Project aerial photo from 1988

Reflection Lake is located south of the project limits and is privately owned. A stream flows north from Reflection Lake in existing culvert crossings at Reflection Drive and Image Drive.

2. Community Council

The project area is within the boundaries of the University Area Community Council. The Council meets on the 1st Wednesday of each month at 7:00 PM at the University Baptist Church.

3. Previous Studies/Reports

a) *Chester Creek Watershed Plan (MOA - June 2005)*

The Chester Creek Watershed Plan was prepared to guide development in the Chester Creek Watershed and recommends policies and objectives that are most beneficial to the watershed as a whole. General overall goals of the plan include improving water quality and managing the quantity of water discharged during storm events. Specific recommendations near/within the project area include increasing pervious surfaces in the Reflection Lake Drainage, transforming the greenbelts dedicated along the stream channel between Image Drive and Reflection Drive from lawn to a marshy multi-channel stream, and daylighting the Reflection Lake tributary by constructing an open stream riparian zone at the Riviera Terrace Trailer Park.

b) East Anchorage District Plan (MOA - December 2014)

The East Anchorage District Plan is an area Land Use Study adopted by MOA in 2014. It provides guidance for the development of transportation, housing, and economic development to enhance the quality of life in East Anchorage. The East Anchorage District Plan boundaries extend from the Glenn Highway on the north to Tudor Road on the south; and from Bragaw Street on the west to the JBER boundary on the east. The Image Drive / Reflection Drive project area is included in this district.

The Plan places a high importance on making East Anchorage safe for walking and biking and encourages the continued maintenance and upgrade of roadways.

4. Planned Area Development

a) Burlwood Bluff Subdivision

White Raven Development is constructing a new privately-owned multi-family residential development located northwest of the project limits on a lot located at the southeast corner of Boniface Parkway and Reflection Drive. The Burlwood Bluff Subdivision development includes 7 multi-family structures with a total of 33 residential units and supporting utilities. The development is currently under construction, the utility infrastructure has been installed and multiple buildings are substantially complete.

b) Loon Cove Drainage Improvements (MOA PM&E Project No. 13-59)

The goal of this MOA PM&E project is to mitigate flooding of homes located at the south end of Loon Cove Circle and, where reasonable, to redirect storm flows away from the privately owned Reflection Lake. During storm events, runoff flows eastward from the end of East 40th Avenue through the backyards of Loon Cove Circle homes and eventually into Reflection Lake. The Loon Cove project will provide a new piped storm drain connection from E. 40th Ave between the homes and discharge into the existing storm drain system located in the south end of Loon Cove Circle. The Loon Cove project, which includes a condition assessment of existing Loon Cove Circle drainage facilities, is currently in the preliminary design phase with construction anticipated in 2018, pending funding approval. Depending on the outcome of the condition assessment, the project could include replacement of the existing storm drain system located in Loon Cove Circle up to the Reflection Drive intersection. This Image/Reflection project needs to coordinate closely with the Loon Cove project to insure a seamless cost effective solution to the area problems.

B. Project Area Considerations

1. Land Use

Existing zoning within the project limits is predominantly R-2M (Mixed Residential District) with the exception of areas east and southeast of Image Drive including

Keyann Circle, Ridgelake Circle, & Defiance Street which are zoned R-2A (Two-Family Residential District, larger lot). See FIGURE 2 for area zoning and roadway classifications map.

- R-2M (Mixed Residential District) is intended for a variety of single-family, two-family, and multi-family dwellings, with gross densities between 5 and 15 dwelling units per acre. The minimum lot size varies depending on the number of dwelling units between 2,400 to 20,000 sf. Minimum setbacks on R-2M zoned properties are 20 feet for the front, 5 or 10 feet for the sides depending on the number of dwelling units, and 10 feet for the back.
- R-2A (Two-Family Residential District, larger lot) is intended primarily for single and two-family dwellings, with gross densities between 5 and 7 dwelling units per acre. The minimum lot size varies depending on the number of dwelling units between 3,500 to 8,400 sf. Minimum setbacks are 20 feet for the front, 5 feet for the sides and 10 feet for the back.

a) Housing and Ownership

Housing within the project limits are all single family homes. The lots are all owned privately. There are 4 lots in the project area that are owned by local Homeowner's associations. These lots encompass common areas adjacent to Reflection Lake and Reflection Lake Creek that flows north from Reflection Lake.

b) Businesses and Religious Institutions

There are no known businesses or religious institutions in the project area.

c) Schools

Project area students are within the following school boundaries:

- College Gate Elementary School
- Wendler Middle School
- East High School

Transportation to school is provided by the Anchorage School District (ASD) for students who live at least 1.5 miles from their neighborhood school. The project area is within the designated walking boundary of College Gate Elementary School but ASD bus service is still provided for students who live within the project limits. There are ASD bus stops within the project limits for College Gate Elementary, Wendler Middle School, and East High School at the following intersections:

- Reflection Drive/Image Drive (north and south)
- Image Drive/Mirage Drive
- Image Drive/Keyann Circle
- Reflection Drive/Loon Cove Circle.

The project team will coordinate with ASD prior to construction of this project to ensure bus stops and students are safely accommodated during the project duration.

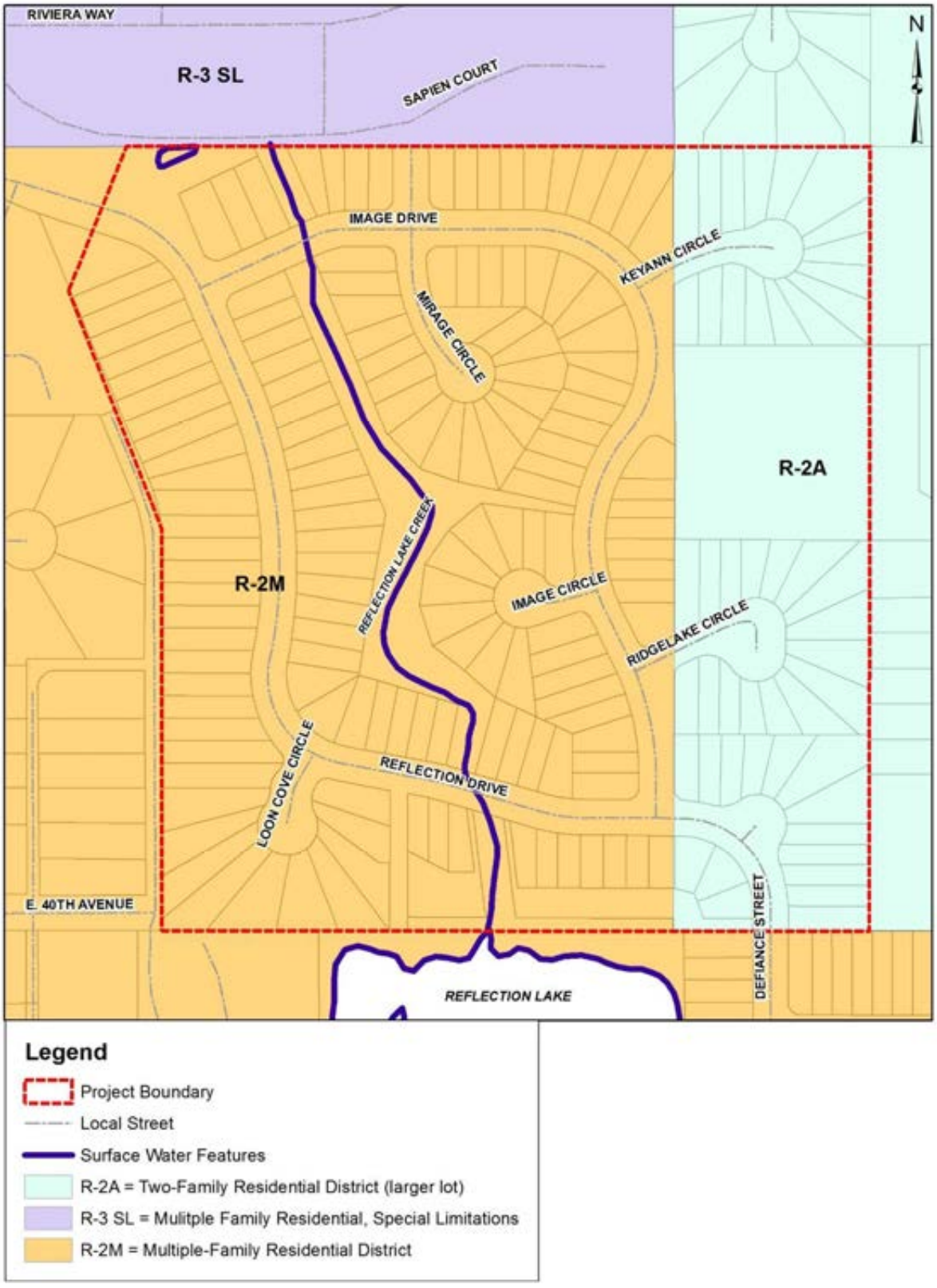


Figure 2 - Zoning and Roadway Classification Map

2. Environmental Constraints

a) Lakes, Streams & Wetlands

According to the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) Portal and the USFWS National Wetlands Inventory mapper, Reflection Lake is a palustrine/ unconsolidated bottom/ permanently flooded/ excavated (PUBHx) waterbody. Reflection Lake is located south of the project limits.

Reflection Lake Creek extends from Reflection Lake and meanders northwards within the project limits and along the back of some of the parcels. Reflection Lake Creek crosses the project area roadways in culverts at two locations: Reflection Drive on the south side of the project and Image Drive at the north side. Both these culvert crossings were upgraded in 2013 as part of the MOA PM&E Riviera Terrace Storm Drain Replacement project (Project Number 08-48) with a 36-inch diameter culvert and a 24-inch overflow culvert at each crossing. Heat trace was also installed in each of the culvert creek crossings and within the stream channel at both the inlet and outlet of the culverts. The culverts were installed with stream substrate in the 36-inch diameter culvert in order to promote fish passage. North of the Image Drive crossing, the stream enters an open channel as shown in the photo to the right then outfalls through a 60-inch diameter piped storm drain system with stream substrate that was also installed as part of the 2013 Riviera Terrace Storm Drain Replacement project. The 60-inch storm drain pipe is located within a storm drain easement on the Riviera Terrace Trailer Court property and discharges to the South Fork of Chester Creek.

Image Drive culvert crossing outfall viewing north

The MOA Wetlands Atlas shows an area of class “C” wetlands (ID# 338) within the project area measuring approximately 0.5 acres. There is also a class “D” wetland located south of the project limits that encompasses Reflection Lake and a portion of Reflection Lake Creek. See FIGURE 3 for location of wetlands within the project area.

Figure 3 - Wetlands Map (wetlands from MOA WMS GIS)

b) *Fish and Anadromous Waters*

According to the Alaska Department of Fish and Game (ADF&G) Anadromous Waters Catalog Interactive Mapper, Reflection Lake Creek is an anadromous stream with coho salmon habitat within the project area (Anadromous Waters Code 247-50-10050-2302-3010-4040). Reflection Lake (AWC 247-50-10050-2302-3010-4040-0010) is identified as a coho salmon rearing habitat as well.

c) *Floodplain and Regulatory Floodway*

A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) #0200050767D and #0200050759D reveal that portions of the project area are within Zone A, a special flood hazard area (SFHA) subject to inundation by a 100-year flood. Mirage Circle, portions of Reflection Drive, and portions of Image Drive in the vicinity of Reflection Lake and Reflection Lake Creek are within the floodplain (see FIGURE 4 for the FEMA flood plain map). These areas do not have a base flood elevation (BFE) determined by FEMA but are within the floodplain and a MOA Flood Hazard Permit will be required for work within Reflection Lake Creek floodplain.

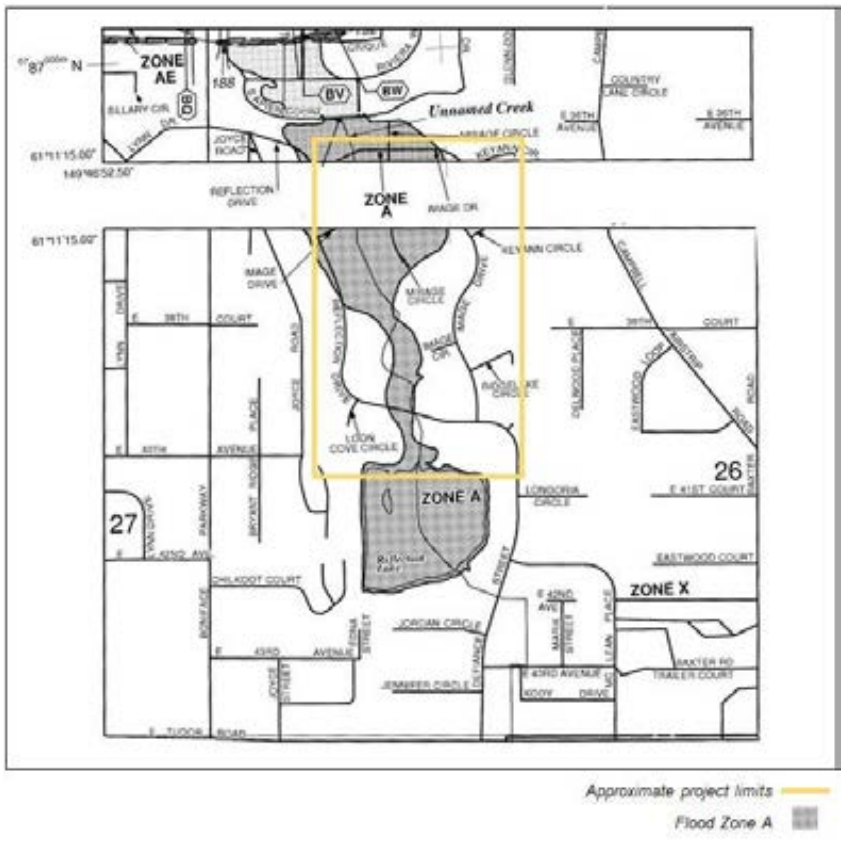


Figure 4 - FEMA Flood Plain Map

During assembly of the Draft Design Study Report, the design team met with the MOA Flood Plain Administrator to discuss the proposed improvements in the flood plain. Per the MOA Flood Plain Administrator, the base flood elevation is

198.0' mean sea level within the project area. Limitations in the 100-year flood plain include no grade elevation changes within 30 feet of the Reflection Lake Creek crossings at Image Drive and Reflection Drive, sewer manhole covers in the 100-year flood plain need to be either raised above elevation 198.0' or sealed, and the proposed lift station should be designed to operate with a storm water elevation of at least 198.0'. Proposed storm drain structures in the 100-year flood plain do not need to be designed to accommodate the 100-year storm event.

d) Contaminated Sites

According to the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Mapper, there is one documented contaminated site located adjacent to (within 0.10 mile of) the proposed project area. The site (Riviera Terrace; Hazard ID 4078) is located at 3307 Boniface Parkway, approximately 385 feet northeast of the proposed project area. The site is listed for surface soil and groundwater contamination by releases from an underground piped fuel oil storage and distribution system. Cleanup was initiated in 1985 and status changed in 2008 to "Cleanup Complete – Institutional Controls." Groundwater at the location of the contaminated site is assumed to flow to the northwest, away from the project area.

In 2016, Golder Associates, Inc. (Golder) performed geotechnical investigation field work as part of the Image / Reflection project and examined soil samples from 15 borings throughout the project area. They encountered potentially contaminated soil at one of the borings which warranted further subsurface exploration to determine potential presence of hydrocarbons in the soil. All laboratory results showed levels of all analyses were either non-detect or below potential ADEC cleanup levels. See APPENDIX M for the full Chemical Data Report. See SECTION 5 for geotechnical analysis and complete summary of the contaminated soil investigation.

Based upon initial geotechnical field investigations and follow up sampling by Golder, the likelihood of encountering contaminated soil or groundwater during the construction phase is low. If suspected contamination is encountered, construction activities would cease in the area and ADEC would be contacted for direction on how to proceed.

e) Migratory Birds and Eagles' Nests

According to the USFWS IPaC Portal, several species of migratory birds may travel through the proposed project area and may be disturbed by vegetation clearing operations. The proposed clearing activities should occur outside of the recommended migratory bird nesting period window for the Southcentral Region (May 1 – July 15) outlined in the 2017 USFWS Region 7 Timing Recommendations for Land Disturbance and Vegetation Clearing.

According to the Wetland Ecosystem Services Portal for Southeast Alaska (WESPAK-SE), no documented eagle nests are located within the proposed project area.

f) Water Quality

Storm water within the proposed project area flows off of the roadway and enters Anchorage's municipal separate storm drain system. Storm water will eventually drain into nearby South Fork Chester Creek and ultimately discharge into Knik Arm. While a goal of the proposed project is to address and remediate drainage issues in the area, overall drainage patterns are not expected to change as a result of the proposed project. See Drainage Analysis SECTION 7.G for proposed permanent water quality measures proposed as part of this project.

Temporary water quality impacts during construction may occur but would be minimized through coordination with resource agencies and use of Best Management Practices (BMPs) as identified in the construction Storm Water Pollution Prevention Plan (SWPPP).

g) Historic Properties, Archeological, and Cultural Resources

If a United States Army Corps of Engineers (USACE) Wetland permit is required for the project, the USACE will proceed in accordance with Section 106 of the National Historic Preservation Act and coordinate with consulting parties as needed to determine if there are any historic properties or cultural resources within the project area.

C. Roadway Characteristics & Function

1. Facility Description

Reflection Drive and Image Drive are the major roadways through the project corridor with Reflection Drive being the main in/out roadway that can be accessed directly from Boniface Parkway to the west or from Defiance Street to the south. Reflection Drive, including where it transitions into Defiance Street, is approximately 0.35 miles long within the project limits and it intersects with Loon Cove Circle and with Image Drive at two locations. Image Drive is approximately 0.32 miles and intersects with the following cul-de-sacs: Mirage Circle, Keyann Circle, Image Circle and Ridgelake Circle. Within the project limits, Defiance Street also includes an eyebrow located on the north side of the roadway.

Reflection Drive and Image Drive are both approximately 33 feet wide measured from back of curb to back of curb (29 feet of pavement). Type 2 (rolled) curb and gutter is installed on all roadways throughout the project limits in order to accommodate the closely spaced driveways. On-street parking is allowed throughout the project limits even though space is limited due to the large number of driveways. Parked cars on-street often encroach onto the sidewalk as shown in the photo below. The posted road speed limit is 25 miles per hour (mph).

The existing roadway grade on Reflection Drive just outside the project limits coming from Boniface Parkway has a grade of 11% but quickly flattens as the roadway enters the project limits. Existing grades on Reflection Drive are typically flat ranging between approximately 0.2% and 0.7% until the roadway transitions into Defiance Street where the grade raises to 8.8% before the roadway extends out of the project limits. Image Drive also has flat grades ranging from approximately 0.2% to 1.2%. There are four existing speed humps in the project area, two on Reflection Drive and two on Image Drive, see FIGURE 5 for locations. There are no pavement makings on the roadway except at the speed humps.

Reflection Drive viewing south, parked car on right encroaching onto sidewalk

The cul-de-sacs within the project limits have roadway grades, widths and lengths as shown in TABLE 1 below. Mirage Circle (north) is a dead-end street without a large radius turnaround or connecting driveways.

Table 1 - Cul-De-Sac Summary

Cul-De-Sac	Approximate Existing Roadway Grade Range	Existing Width at Neck (measured from back of curb to back of curb)	Length (feet)
Mirage Circle (south)	0.2% -1.2%	30 feet	320
Mirage Circle (north) Dead End	0.2% - 0.9%	33 feet	140
Keyann Circle	1.1% - 4.8%	30 feet	300
Image Circle	0.4% - 1.2%	33 feet	180
Ridgelake Circle	0.1% - 1.7%	33 feet	340
Loon Cove Circle	0.5% - 2.3%	33 feet	180

2. Roadway Functional Classification

The functional classification affects the basic design criteria including design speed, number of lanes, lane and shoulder width, right-of-way (ROW) width, distance between intersections, and alignment. The 2014 Official Streets & Highways Plan (OS&HP) classifies all roadways within the project limits as local roadways.

3. Pedestrian Facilities

Pedestrian facilities within the project limits include 4-foot wide sidewalks attached to the back of curb located along the west and south side of Reflection Drive and Image Drive. Just north of the project limits the sidewalk is detached along the south side of Reflection Drive and then connects to Boniface Parkway. There is also a sidewalk on the west side of Mirage Circle (North) and along both sides of Ridgelake Circle and Defiance Street. During multiple site visits, cars were observed parked on the sidewalk and some pedestrians tend to use the roadway rather than the sidewalk because of this. No specially designated bicycle facilities occur within the project area. There are not ADA compliant curb ramps at the intersections; the curb ramps typically lack accessible curb type and/or detectable warning panels. See FIGURE 5 for location of existing sidewalks within the project limits.

4. Condition of Facilities

Image Drive at Mirage Circle viewing east

The existing conditions of the roadway pavement in the project area include frost cracking, especially on the west and north parts of the project. There are also persistent transverse cracks in the pavement throughout the project roadways that are likely related to the many utility connections and differential frost heave within the trench backfill. There are frequent pavement patches at manholes, indicative of movement of the manholes relative to the road surface, as well as numerous depressions along the curb and gutter. The concrete sidewalks and curb and gutter are badly broken in many areas as shown in the photo above. The broken concrete is likely caused by poor subgrade conditions or frost movement, which is exacerbated by vehicles parking on the sidewalks and poor drainage leading to saturated foundations materials.

Figure 5 - Existing Sidewalks and Speed Humps

5. Area Landscaping

The entry to the project area at the intersection of Image Drive and Reflection Drive viewing towards Boniface Parkway

The landscaping at the entrance to the Image Drive/Reflection Drive area project limits from Boniface Parkway consists of a well-maintained lawn area, with mature spruce tree plantings, a split rail fence, and a sidewalk on the south edge of Reflection Drive, and a mix of birch, spruce, aspen, cottonwood, and natural undergrowth on the north side of Reflection Drive. The natural mix of mature trees and undergrowth on the north side of Reflection drive screens the view of the adjacent Riviera Terrace Trailer Court.

Several large boulders, two to six feet in diameter, set in lawn and rock mulch mark the northeast and southeast corners, and west edge, of the northernmost Image Drive/Reflection Drive intersection. From this point on, the residential landscape in the Image Drive/Reflection Drive area consists of a uniform mix of lawn and small landscape beds with occasional trees and shrub plantings.

Private improvements as those pictured above on Reflection Dr occur at many locations within the ROW

In many instances, landscaping extends to the back of the sidewalk or back of curb, and in some areas private homeowner improvements, such as mulched planting beds, decorative edging, and large tree plantings take place in the right-of-way (ROW). Decorative fences also extend to the back of curb in a few places. Small landscaped areas consisting of two to three-foot diameter boulders, occasional shrub or perennial plantings, and lawn occur at the neighborhood intersections where space in the ROW allows. Some of these private improvements cause problems with roadway maintenance, particularly snow removal and storage.

D. Lighting

There are existing street lights located at all the intersections, intermittently along Reflection Drive/Image Drive and within each of the cul-de-sacs. The existing street lighting system in the project area includes 27 direct embedded, 30-foot lighting poles with LED fixtures that are owned and maintained by the MOA. The existing light poles do not meet the lighting requirements of the MOA Design Criteria Manual (DCM) or the current construction requirements of the MOA and several poles will be directly impacted by this project.

Existing street light at Image Drive/Reflection Drive intersection (south) viewing northwest

E. Utilities

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

1. Water

   The project area is served by public, piped water systems owned and operated by Anchorage Water and Wastewater Utility (AWWU). The water mains in the project area range in size from 8-inch to 12-inch in diameter and are made of ductile iron (DI) pipe. Depth of bury for the water mains is generally 10 feet below ground surface (bgs). Service lines, hydrants, valves, key boxes, and other water appurtenances are located throughout the project area. AWWU has not indicated any future water extension or improvement plans within the project area.

2. Sanitary Sewer

   The project area is served by public, piped sanitary sewer systems owned and operated by AWWU. The gravity sewer mains in the project area are 8-inch diameter DI pipe and 14-inch diameter asbestos concrete (AC) pipe. The depth of bury for the sewer mains is generally 7 to 10 feet bgs. Service lines, manholes, cleanouts, and other sewer appurtenances are located throughout the project area. AWWU has not indicated any future sewer extension or improvement plans within the project area.

3. Storm Drain

   See SECTION 4 for summary of the existing storm drain facilities in the project area.

4. Electric

   Chugach Electric Association (CEA) owns and operates underground electric lines and appurtenances in the project area. Electric lines are generally single phase primary conductors and are located in electric easements at back of properties. There are multiple locations along Reflection Drive and Image Drive where the electrical line crosses the roadway. Junction boxes and pedestals are generally located in easements at the back of properties. A switch cabinet is located outside the project area at the intersection of Reflection Drive and Boniface Parkway. There are three-phase power primary conductors along Boniface Parkway. CEA has not indicated any future electric extension or improvement plans within the project area.

5. Telephone

   Alaska Communication Systems (ACS) owns and operates underground telephone lines within the project area. ACS's underground lines are 24-gauge and are typically located along the back of the properties. At the south-east end of the project where the properties back to Reflection Lake, the cable lines are located along the front of the properties and are encased in 4-inch PVC conduit. There are multiple locations along Reflection Drive and Image Drive where the telephone line crosses the roadway. Pedestals are also typically located along the back of the properties. ACS has not indicated any future telephone extension or improvement plans within the project area.

6. Cable and Fiber Optic

   General Communications, Inc. (GCI) owns and operates underground cable and fiber optic lines within the project area. Underground cables range in size from .500 to .750 and are mostly located along the back of the properties. At the south-east end of the project where the properties back to Reflection Lake, the cable lines are located along the front of the properties. There are multiple locations along Reflection Drive and Image Drive where the cable line crosses the roadway. A fiber optic line runs along the south and east sides of the project and includes multiple roadway crossings. Pedestals are also mostly located along the back of the properties. GCI has not indicated any future cable or fiber optic extension or improvement plans within the project area.

7. Natural Gas

   ENSTAR owns and operates natural gas facilities within the project area. Natural gas mains in the project area range in size from 1-inch to 2-inch in diameter and are made of plastic. The gas mains are located within the ROW and typically between 5-10 feet from the ROW lines. There are no high-pressure transmission gas mains

within the project area. ENSTAR has not indicated any future natural gas extension or improvement plans within the project area.

F. Right-of-Way and Easements

Existing right-of-way (ROW) is typically 60 feet wide for Image Drive, Reflection Drive, Defiance Street and Mirage Circle (north). The ROW is greater than 60 feet wide and varies at the north portion of Reflection Drive near Boniface Parkway and on the south portion of Image Drive near Reflection Drive. The existing ROW for all project cul-de-sacs measured at the neck is 50 feet wide excluding Loon Cove Circle. Loon Cove Circle has an existing right-of-way width that varies up to 70 feet.

Existing easements on private properties vary in width and include: telephone & electric, creek, sanitary sewer, joint access, vegetation screening, water, gas, creek maintenance and maintenance easements (ME). See APPENDIX I for layout of existing ROW and easements.

3. Design Criteria & Standards

Project design criteria are based on the roadway characteristics, functional classification, and road ownership. All roadways and cul-de-sacs in the project area are classified as secondary (local) urban residential roadways and are owned and maintained by the MOA.

A. Project Design Standards

The 2007 MOA PM&E Design Criteria Manual (DCM) provides detailed design criteria for the development of roadways within the MOA. The documents listed below provide additional design guidance, standards and requirements for this project.

- Anchorage Stormwater Manual, July 2017, MOA.
- Official Streets and Highways Plan (OS&HP), 2014, MOA.
- 2035 Metropolitan Transportation Plan, 2012, MOA.
- Areawide Trails Plan (ATP), 1997, MOA.
- Anchorage Pedestrian Plan (APP), 2007, MOA.
- Anchorage Bicycle Plan, 2010, MOA.
- A Policy on Geometric Design of Highways and Streets, 6th Edition (AASHTOGB), 2011, American Association of State Highway and Transportation Officials (AASHTO).
- Roadside Design Guide (RDG), 4th Edition, 2011, American Association of State Highway and Transportation Officials (AASHTO).
- Manual on Uniform Traffic Control Devices (MUTCD), 2009 with Revisions 1 and 2, Federal Highway Administration (FHWA).
- Guide for the Development of Bicycle Facilities, 4th Edition, 2012, AASHTO.
- Traffic Calming Policy Manual, 2005, MOA.
- Alaska Traffic Manual (ATM), 2012, ADOT&PF.
- Proposed Accessibility Guidelines for Pedestrians in Public Right-of-Way, 2011, United States Access Board.
- Anchorage Municipal Code Title 21 – Land Use Planning.
- A Strategy for Developing Context Sensitive Transportation Projects, 2008, MOA.

B. Design Criteria Summary

A summary of design criteria pertinent to this project can be found in TABLE 2 below. Proposed deviations from design criteria are presented in SECTION 14.

Table 2 - Design Criteria Summary

	Criteria	Design Std. Value	Reference
Traffic Data	Functional Classification	Secondary Street: Urban Residential	DCM 1.3 C
	Image Drive: AADT – 2018	394 vpd	Field Data
	Image Drive: AADT – 2040	540 vpd	Assumed Growth
	Reflection Drive: AADT – 2018	450 vpd	Field Data
	Reflection Drive: AADT – 2040	600 vpd	Assumed Growth
	Design Vehicle	WB-50	DCM 6.4 B
	Design Structural Loading	HS 20	
	Design Speed	25 MPH	DCM Table 1-6
	Posted Speed	20 MPH	DCM 1.5.E
Horizontal Alignment	Horizontal Curve Radius, Minimum, No Super-elevation	150 ft	DCM Table 1-9
	Stopping Sight Distance, Min	155 ft	DCM 1.9.D
	Clear Sight Triangle Length	280 ft	DCM Figure 1-19
Vertical Alignment	Vertical Grade, Maximum	6.0%	DCM 1.9.D.2.c
	Vertical Grade, Maximum for Hill Areas	10.0% for ADT ≤ 2,000	DCM 1.9.D.2.c
	Vertical Grade, Minimum	0.5% for street with curb and gutter, 1.0% other	DCM 1.9.D.2.a
	Vertical Curve K-Value, Min Crest Curve	12	DCM Figure 1-16
	Vertical Curve K-Value, Min Sag Curve	26	DCM Figure 1-17
Cross Section	Number of Lanes	2	DCM Table 1-6
	Lane Width	10 ft for ADT ≤ 300 11 ft for ADT 301-1,000	DCM Table 1-6
	Number of Parking Lanes	1	DCM Table 1-6
	Width of Parking Lanes	7 ft	DCM Table 1-6
	Shoulder Width (No Parking Lane)	3.5 ft	DCM Table 1-6
	Curb & Gutter	Type 2 (DCM) Type 1 (Title 21)	DCM Figure 1-13 MOA Title 21.08.050.G
	Side slopes	2:1 maximum	DCM 1.9.D.5
	Clear Zone	14 feet minimum	See Section 3.C.4
	Sidewalk Requirements & Width	Both sides of roadway, 5 ft	DCM Figure 1-13, MOA Title 21.85.090
	Sidewalk Separation from Back of Curb	7 ft	DCM 4.2 H
	Curb Return Radii at Residential Side Streets	20 ft	DCM Figure 1-22
	Max driveway width, up to 7-plex	20 ft 28 ft w/ restrictions	DCM Appendix 1D
	Max driveway grade, up to 7-plex	± 10%	DCM Appendix 1D
	Landing grade/length, up to 7-plex	± 2% for 12 ft	DCM Appendix 1D

*Lighting design criteria is discussed in Section 7.L of this DSR.

C. Specific Design Criteria

The appropriate roadway section is determined by considering project traffic volumes and land use. The DCM classifies Image Drive, Reflection Drive, Defiance Street and the cul-de-sacs in the project as secondary (local) urban residential roadway. Secondary streets typically have lower design volumes and often provide direct access from adjacent lots. Based on Title 21 Land Use Zoning, the project roadways are “urban” roadways. Urban roadways are required to include a paved surface, curb and gutter, sidewalks, walkways, street lights, traffic control devices, street signs, landscaping, and storm drains.

1. Design Speed

   The design speed is a selected speed to which various geometric features of the roadway are coordinated to achieve a balanced design, and should be a logical speed with respect to anticipated speed limit, topography and functional classification of the roadway. The design speed affects the length of sight distance available along the roadway’s horizontal alignment and vertical profile, particularly at intersecting roadways and pedestrian facilities. As design speeds increase, longer sight distances are required to provide more reaction time and braking distance to respond to roadway obstacles.

   The DCM indicates a secondary roadway with less than 1,000 Average Daily Traffic (ADT) should have a design speed of 25 MPH. Generally, the posted speed limit should be the same as the 85th percentile speed.

2. Roadway Cross Section

   Based on the DCM, secondary urban roadways with less than 1,000 ADT should have a street width of 33 feet measured from back of curb to back of curb, 2 travel lanes, 1 parking lane, Type 2 curb and gutter, and pedestrian facilities on both sides of the roadway. The typical lane width for a local roadway with less than 1,000 ADT but more than 300 ADT is 11 feet. For cul-de-sacs with ADT from 0-300, lane widths are reduced to 10 feet resulting in a street width of 31 feet measured from back of curb to back of curb. Local roadways are typically not provided with pavement markings thus on-street parking can vary either side of the roadway.

   MOA Title 21.08.050.G differs from the DCM regarding curb types for local streets. Title 21 states that curb and gutter shall be the AASHTO vertical type (Type 1 curb and gutter) except for curb and gutter within the arc of a residential scale cul-de-sac shall be Type 2 rolled curb and gutter.

   Per the DCM Figure 1-13, 5-foot wide sidewalks are to be provided on both sides of a local roadway. It is preferable for the sidewalks to be separated from the roadway to provide pedestrian comfort and safety, increase intersection sight distances, and provide room for snow storage. A clear area 7 feet beyond the back of curb is required for snow storage. The sidewalk can be considered as part of the snow storage area.

3. Accessibility Guidelines

The current requirements for accessibility in the MOA are based on the Americans with Disabilities Act (ADA). The project uses guidelines published in Proposed Accessibility Guidelines for Pedestrian Facilities in Public Right-of-Way- July 26, 2011 (ADA Guidelines) by the United States Access Board. A summary of some of the ADA design criteria pertinent to the Image Drive / Reflection Drive project is provided below:

- R302.3 - The continuous clear width of pedestrian access routes shall be 4.0 feet minimum.
- R302.4 - Where the clear width of pedestrian access routes is less than 5.0 feet, passing spaces shall be provided at intervals of 200 feet maximum.
- R302.5 - Where pedestrian access routes are contained within a street or highway right-of-way, the grade of pedestrian access routes shall not exceed the general grade established for the adjacent street or highway.
- R302.5.1 – Where pedestrian access routes are contained within pedestrian street crossings, the running grade of the pedestrian access route shall be 5% maximum.
- R302.6 – The cross slope of pedestrian access routes shall be 2% maximum.
- R304.3 – Parallel curb ramps shall comply with figure 304.3.1 provided in the ADA Guidelines and include a turning space with minimum dimensions of 4.0 feet x 4.0 feet at the bottom of the ramp.
- R304.3.2 – The running slope of the curb ramp shall be in-line with the direction of sidewalk travel and shall be 5% minimum and 8.3% maximum but shall not require the ramp length to exceed 15.0 feet maximum. The running slope of the turning space shall be 2% maximum in any direction.
- R304.5.1 – The clear width of curb ramp runs and turning spaces shall be 4.0 feet minimum.
- R304.5.2 – Grade breaks at the top and bottom of curb ramp runs shall be perpendicular to the direction of the ramp run.
- R304.5.3 – The cross slope of curb ramps and turning spaces shall be 2% maximum.

The Public Rights-of-Way Accessibility Guidelines recognize that it is not always possible for altered elements (reconstruction of existing facilities) to fully comply with new construction requirements because of existing physical constraints. The guidelines state:

> *Where existing physical constraints make it impractical for altered elements, spaces, or facilities to fully comply with new construction requirements, compliance is required to the extent practicable within the scope of the project. Existing physical constraints include, but are not limited to, underlying terrain,*

right-of-way availability, underground structures, adjacent developed facilities, drainage, or the presence of a notable natural or historic feature.

All elements included in the project that cannot meet the requirements of ADA due to "technical infeasibility" will be documented.

4. Roadway Clear Zone & Horizontal Offset

   The DCM defines the roadway clear zone to be:

   …the total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. The desired width of the clear zone is dependent on the traffic volume, design speed, and roadside geometry.

   The DCM references AASHTO's Roadside Design Guide (RDG) for rural conditions (i.e. no curb and gutter) but it is unclear as to the applicability of the clear zone concept to curbed urban roadways. In 2011, FHWA published the following guidance regarding clear zone along curbed roadways on their website:

   Since curbs are now generally recognized as having no significant containment or redirection capability, clear zone should be based on traffic volumes and speeds, both without and with a curb.

   The recommended clear zone width is a function of the design speed, traffic volume, functional classification of the roadway, and the side slope of the roadway. The clear zone recommended for a roadway with a design speed of ≤ 40 MPH and an ADT of under 750 is 14-20 feet (7-10 feet with a foreslope of 1V:4H or flatter and 7-10 feet with a backslope of 1V:3H or flatter).

   However, the AASHTOGB, similar to the DCM, recognizes the impracticability of constructing a full clear zone, in accordance with the RDG, in urban areas.

   Where establishing a full-width clear zone in an urban area is not practical due to right-of-way constraints, consideration should be given to establishing a reduced clear zone or incorporating as many clear zone concepts as practical, such as removing roadside objects or making them crashworthy.

5. Lighting Requirements

   The DCM's lighting requirements are based on the IESNA RP-8-00 American National Standard Practice for Roadway Lighting.

   The IESNA does not make recommendations or provide guidelines for partial lighting of intersections and roadways only (Section 1.1). It only provides recommendations "for designing continuous lighting systems for roadways."

   Several studies have also shown that the primary benefit of lighting intersections is a reduction in pedestrian, bicycle, and fixed object crashes (Section 3.6.2) that occur at night. Intersections should be illuminated to increase safety.

6. Storm Drain

   A summary of the pertinent storm drain design criteria per the Anchorage Stormwater Manual (ASM) is provided below:

   - Storm drain pipes shall be corrugated polyethylene pipe (CPEP) due to corrosion issues in Anchorage area.
   - Minimum diameter of storm drain pipe is 12 inches.
   - Minimum pipe slope is 0.30%.
   - The storm drain system shall not be surcharged during the design storm event.
   - At the design flow, minimum pipe flow velocity is two feet per second (fps). Maximum pipe flow velocity is 13 fps.
   - Minimum depth of cover over a gravity storm drain pipe without thaw protection is four feet.
   - Insulation is required for pipes if the depth of cover is less than four feet. If storm drain pipe is located under a roadway structural section and insulation is included in roadway section, additional insulation for pipe is not required.
   - A thaw system is required if the depth of cover is less than three feet.
   - Maximum manhole spacing is 300 feet.
   - Minimum invert elevation difference across a manhole is 0.05 feet.
   - Minimum cover over a culvert is 12 inches.
   - Flared end sections or headwalls are required on all storm outfalls.

7. Stormwater Lift Station

   A summary of the major stormwater lift station design criteria per the Anchorage Stormwater Manual (ASM) is provided below:

   - Wet well and pump capacity shall be sufficient to accommodate the 10-year storm event without surcharging the wet well inlet pipe and accommodate the 5-year design event without surcharging the inlet pipe with any one pump non-operational.
   - Wet well shall be sized to limit motor starts to not more than 6 starts per hour per pump.
   - Wet well ventilation is required and consists of schedule 40 steel gooseneck vent piping with bird screen.
   - Wet well shall be designed with a sump, baffle wall or other accommodation for collection of rocks and stones. In general, wet well sumps shall be designed to avoid directing debris into pump intakes.
   - Lift stations shall be accessible by maintenance personnel year round on roads or trails capable of accommodating H-20 traffic loading and readily traversable by maintenance vehicles.

- Each lift station shall have a minimum of 2 pumps. One spare pump of each pump size installed shall be provided to MOA Street Maintenance.
- Pumps shall be capable of passing spheres at least 3-inches in diameter.
- Whenever possible, pumps shall be 3-phase. All pumps 5-horsepower and larger shall be three-phase.
- When required by the electrical utility, solid state reduced voltage current-limiting motor starters (soft starts) shall be provided to limit starting loads.
- Isolation valves and check valves shall be provided for each pump.
- Force main shall be high-density polyethylene (HDPE) pipe or ductile iron (DI) pipe if suitable corrosion protection is provided.
- Minimum force main diameter is 4 inches.
- Minimum force main velocity is 3 feet per second.
- Wherever possible, the force main shall be sloped downward such that the force main drains completely between pumping cycles.

8. Landscaping

   All of the roads in the project area are classified as local roads, therefore no special landscape design requirements from the DCM apply to the project landscaping.

4. Existing Drainage and Analysis

The project area currently has two main piped storm drain systems that extend the length of Reflection Drive and Image Drive, with several connecting side street systems. These systems were constructed of corrugated metal pipe (CMP) and are approximately 30 years old. The CMP pipe has been found to be structurally unsound in some locations and in high risk of collapse due to corrosion. The inspection photo to the right was taken in 2015 and shows a belly in the existing Reflection Drive 18-inch CMP pipe and signs of pipe corrosion.

18-inch CMP storm drain in Reflection Drive (photo courtesy Stephl Engineering, LLC)

In addition to deteriorating pipe, several other drainage concerns exist. Ponding issues are widespread along the project roadways. High groundwater and poor soils are also present throughout the neighborhood, resulting in roadway degradation. During large rain events, water levels in Reflection Lake Creek rise significantly causing submerged outlet conditions for the Image Drive storm drain that discharges into Reflection Lake Creek.

One of the primary goals for this project is to improve overall surface and subsurface drainage in the project area to prevent flooding and avoid saturated soils that can lead to frost heaving. In order to meet this goal, a hydrologic and hydraulic (drainage) analysis was performed to determine if the stormwater conveyance system is adequately sized to handle the expected runoff events. Based on the results from the drainage analysis, information collected during field investigations, and correspondence with MOA Watershed Management Services (WMS) and Street Maintenance, a proposed storm drainage system will be developed that will meet the following objectives:

- Replace aging/failing drainage infrastructure
- Size new piping to convey updated design storm events
- Provide water quality treatment for storm runoff
- Address ponding and high groundwater issues
- Minimize adverse downstream impacts
- Improve maintenance efficiency

These topics are discussed in more detail below. The proposed drainage improvements are discussed in SECTION 7.G.

A. Existing Conditions

1. Drainage Basin Delineation

   Contributing drainage basins were delineated using several methods, including topographical mapping, aerial photography, parcel boundaries, and MOA Watershed

Management's hydrography geodatabase (HGDB). Based on HGDB mapping, the project area is located within the Upper Chester Creek watershed and the Reflection Lake Drainage area. More specifically, the entire project is encompassed by Subbasin ID #174 (33.4 acres) and #500 (25.9 acres). Refer to Figure 1, APPENDIX H depicting these boundaries.

The larger scale watersheds and subbasins mapped in HGDB were further refined for this project to better reflect the stormwater runoff contributing directly to the project area. For this drainage study, a total of 18 catchments were delineated within Subbasins #174 and #500 for the existing condition. See Figure 2, APPENDIX H for project catchment areas.

The contributing catchments are characterized primarily by densely spaced, single family homes. The density of the housing increases the impervious surfaces (roofs and driveways) throughout the project area, resulting in increased runoff. The majority of stormwater runoff from the catchments is generally directed toward the adjacent roadways, where it is conveyed by curb and gutter into curb inlets, which tie into the Image Drive and Reflection Drive piped drainage systems. These systems are described in more detail in SECTION 4.A.3. The back portion of parcels abutting Reflection Lake Creek drain directly into the waterway and are not conveyed through these piped systems. These catchments, denoted as C-1 and C-2, are depicted on Figure 2, APPENDIX H.

In order to develop the drainage model, each catchment was characterized in terms of its area, ground cover type, imperviousness, slope, soil type, and various other factors. Some of the more influential factors are briefly discussed below:

a) Composite Curve Number

A composite curve number was calculated for each catchment area. The composite curve number characterizes the storm runoff properties for a particular area based on ground cover and soil type. For example, high curve number values (such as 98 for paved areas) result in high runoff, with minimal losses. Lower values (such as 70 for naturally vegetated surfaces), correspond to an increased ability of the soil to retain rainfall, and will produce much less runoff than an impervious surface. The composite curve number combines the different ground cover types, weighting them by the percentage of area for that particular catchment.

b) Time of Concentration

Time of concentration (T_c) 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 per Section 4.6 of the Anchorage Stormwater Manual (ASM). Travel times can depend on many factors including catchment size, topography, land cover, and use. There are several different methods available to compute T_c. For this analysis, the Modified Kinematic Wave method was used.

For a complete summary of each catchment and the input parameters used for the hydrologic and hydraulic analysis, refer to APPENDIX H.

2. Waterways

Reflection Lake Creek flows from Reflection Lake to the south, bisecting the project area flowing northwards. The stream crosses the project area roadways at two locations: Reflection Drive at the south side of the project and Image Drive at the north side. Both the Image and Reflection Drive storm drain systems eventually discharge runoff into Reflection Lake Creek. These crossings and outfall locations will be discussed in further detail in SECTION 4.A.3 below.

For additional information regarding waterways (lakes, streams, and wetlands) within the project area, refer to SECTION 2.B.2.A).

3. Conveyance Systems

The following provides a description of the existing storm runoff conveyance systems within the project area or systems adjacent to Image and Reflection Drive that influence drainage. The drainage systems described below are all owned and maintained by MOA Maintenance.

a) Image Drive System

The Image Drive storm drain system extends to approximately 75 feet north of the Image Drive/Reflection Drive intersection on the south side of the project limits. Separate storm drain pipes are connected from Mirage Circle, Ridgelake Circle and Image Circle. The Image Drive system generally flows northward and outfalls into Reflection Lake Creek north of Image Drive and east of the existing roadway culverts. Storm drain pipe ranges in size from 8-inch to 18-inch and was mainly constructed of corrugated metal pipe (CMP) in phases from the mid-80's to mid-90's. The majority of the CMP pipe is perforated (subdrain) to intercept groundwater within the structural section of the roadway. Piping extending into Ridgelake Circle was constructed of 12-inch corrugated polyethylene pipe (CPEP). The pipes typically have approximately 3 to 4 feet of cover.

During normal storm drain flows, the outlet pipe of the Image Drive system is partially to completely submerged in Reflection Lake Creek. This tailwater condition results in a flow restriction in the Image Drive system and flow from the stream backs up into this system.

b) Reflection Drive System

The Reflection Drive storm drain system upstream limits is just east of the Image and Reflection Drive intersection to the eyebrow on Defiance Street. Separate storm drain pipes are connected from Loon Cove Circle and an overflow storm drain pipe from the recently constructed on-site storm drain system at the Burlwood Bluff Subdivision parcel located southeast of the Boniface Parkway and Reflection Drive intersection. The Reflection Drive system also flows northward and outfalls into a sedimentation basin located between Reflection Drive and

Sapien Court at the north end of the project. The sedimentation basin is overgrown and in need of maintenance. Similar to the Image Drive system, the Reflection Drive system consists primarily of perforated CMP ranging in size from 8-inch to 18-inch and was constructed in the same time frame. Loon Cove Circle was constructed in the late 90's and has a 12-inch CPEP pipe extending to the south end of the cul-de-sac. The pipes typically have approximately 3 to 4 feet of cover.

c) *Roadway Culvert Crossings*

Reflection Lake Creek crosses the project area roadways through culverts at two locations: Reflection Drive near the south side of the project and Image Drive at the north end. Both of these culvert crossings were upgraded in 2013 as part of the MOA PM&E Riviera Terrace Storm Drain Replacement project (Project No. 08-48). Each crossing location consists of a 36-inch CMP culvert and a 24-inch CPEP overflow culvert. The 36-inch culvert is filled with stream substrate to promote fish passage. Each culvert is outfitted with heat trace for freeze protection.

d) *Downstream Systems*

Downstream of the Image and Reflection storm drain system outfalls, stormwater runoff and flows from Reflection Lake Creek are conveyed through a piped storm drain system that was also installed in 2013 as part of the Riviera Terrace Storm Drain Replacement project. This system consists of a 60-inch CMP pipe that extends north from Sapien Court to its outfall at the South Fork of Chester Creek, located northwest of Lee Street and Crique Place intersection. The pipe is filled with approximately 2 feet of stream substrate to promote fish passage.

e) *Footing Drains*

Existing footing drain services are stubbed out to many of the parcels in the project area where a storm drain or subdrain line exists in the ROW. However, the parcels on the west side of Reflection Drive from Loon Cove Circle to Image Drive, don't have footing drain service stub outs. Based on resident feedback, many of these homeowners experience groundwater issues in their crawlspace. It is unclear how many parcels are actually connected to the footing drain service stub outs.

Existing overgrown sedimentation basin

4. Water Quality Treatment

Stormwater runoff from the Image Drive system is currently not being treated prior to discharging into Reflection Lake Creek. As noted above, the Reflection Drive system outfalls into a sedimentation basin located between Reflection Drive and Sapien Court. Although this basin is not

being maintained, it still provides some water quality treatment by biofiltration and detaining sediment-laden runoff, allowing sediment to settle out before being conveyed downstream to Chester Creek.

5. Drainage Concerns

Significant ponding occurs throughout the project limits due to flat grades and inadequate surface drainage conveyance. Poor drainage typically leads to roadway degradation, such as heaving, cracking, and pavement failure over time as shown in the photo to the right. Image and Reflection Drive are both showing signs of pavement distress due to these issues.

Ponding along the west side of Reflection Drive viewing north

During construction of the 2013 Riviera Terrace Storm Drain Replacement project, several existing CMP pipe segments were identified as having significant invert corrosion issues. The Image and Reflection Drive systems were constructed primarily with CMP approximately 30 years ago, therefore corrosion and other pipe integrity issues likely exist throughout the project corridor.

The Image and Reflection Drive systems were installed relatively shallow due to topography limitations at the corresponding outfalls. This limits the system's ability to remove groundwater from the roadway structural section. Additionally, the outfall for the Image Drive system is completely submerged during large storm events, decreasing its capacity.

B. Hydraulic and Hydrologic Model Results

A hydrologic and hydraulic (drainage) analysis provides the basis for an evaluation of the adequacy of the storm drain infrastructure within the project area. Analysis of the model includes calculating the peak discharge from each drainage basin and peak capacities of each pipe segment for both the existing and the proposed conditions. This process helps determine the location of problem areas for the existing system and ensures the proposed storm drain system is properly sized. Preparation and evaluation of the hydrologic and hydraulic model was performed in accordance with the ASM. Supporting data and modeling for the drainage analysis can be found in APPENDIX H.

In addition to sizing the conveyance systems, the drainage model provides peak runoff flows and volumes to size water quality treatment systems. Per the ASM, treatment must be provided for stormwater runoff generated from the first 0.52 inches of rainfall event. As noted in SECTION 4.A.4, existing water quality treatment measures do not meet

current requirements. Proposed options and techniques for treatment will be discussed in SECTION 7.G.

1. Updated MOA Stormwater Management Policies

   MOA is in the process of updating their stormwater-related design criteria to meet the new Alaska Pollutant Discharge Elimination System (APDES) and Municipal Separate Storm Sewer System (MS4) permit requirements and policies. These updates are reflected in the ASM, which has an expected adoption date of January 1, 2018.

   PM&E has requested that CRW adhere to the new design criteria for this project. Some of the more notable changes that impact this project include increased design storm depths, updated storm distribution, and the use of Green Infrastructure (GI) for water quality treatment.

2. Design Storm Depth & Distribution

   The current MOA design storms described in Chapter 2 of the Design Criteria Manual (DCM) and the supporting Drainage Design Guidelines (DDG) were developed based on data collected at Ted Stevens Anchorage International Airport. These design storms are updated in the ASM based on data from the National Oceanic and Atmospheric Administration (NOAA) released Volume 7 of Atlas 14, Precipitation-Frequency Atlas of the United States (Atlas 14). Atlas 14 is considered the most up-to-date design storm analysis available for Alaska and for the majority of the United States. This data is currently being utilized by other national leaders in stormwater and drainage design.

   Per ASM Table 4.2-1 (MOA Design Storm Depths), the following design storms and depths (based on Atlas 14 data) were evaluated to predict runoff response and meet design requirements:

   - Water Quality Treatment: 90th Percentile, 24-hour – 0.52-inches
   - Conveyance Design & Peak Flow Control: 10-year, 24-hour – 2.28-inches
   - Project Flood Bypass: 100-year, 24-hour – 3.59-inches

   It should be noted that both the volume and peak intensity for the majority of Atlas 14 design storms increased significantly compared to the current MOA design storms.

   Similar to the design storm depths, the storm distribution was also updated based on Atlas 14 data to better reflect the shape of storms in the Anchorage and Eagle River areas. The design storm distribution used for drainage modeling is based on the hyetograph provided in APPENDIX D, as required in Section 4.2.4 of the ASM.

3. Orographic Factor

   Based on project location, a 1.20 orographic factor was applied to the design storm volumes. Refer to Figure 4.2-3 (Orographic Factor Map – Anchorage) in APPENDIX H.

4. Model Information

   A hydrologic and hydraulic (drainage) model was assembled to analyze the existing and proposed conditions of each contributing catchment, as well as the corresponding conveyance systems throughout the project area. The model was developed using Bentley Civilstorm V8 computer software.

   The NRCS SCS Curve Number method was used to model precipitation loss and to estimate runoff from each catchment. As noted in SECTION 4.A.1, a composite curve number was calculated based on land cover type for each catchment area. The drainage analysis approach is consistent with the guidelines provided in the ASM.

   The existing storm drain piping systems included in the model were input based on surveyed information and record drawings. This information includes pipe size, type, inverts, and slopes.

   Supporting data, figures, and results for the drainage analysis can be found in APPENDIX H. Refer to SECTION 7.G for drainage model information and results for the proposed condition.

5. Model Results

   A total of 18 contributing catchments were delineated and evaluated for runoff response for the existing condition. Catchment input parameters and peak stormwater runoff from each catchment during the 10-year design storm is summarized in Table 1 and 2, APPENDIX H.

   Peak pipe flows for the existing Image and Reflection Drive drainage systems described in SECTION 4.A.3 are shown on TABLE 3 below for the 10-year, 24-hour design storm event. Refer to FIGURE 6 below to correlate the location of each pipe segment with TABLE 3. TABLE 3 lists all the pertinent pipe information, as well as the peak flow calculated by the model. The full flow capacity for each pipe segment is also presented in the table for comparison purposes.

   Generally speaking, if the peak flow is less than the full flow capacity, the pipe will convey the flow without restriction. However, the table identifies numerous pipes surcharging despite having adequate capacity. This is due to undersized pipe downstream that effectively causes a bottleneck condition. This condition occurs for both the Image and Reflection Drive drainage systems. Both systems experience surcharging conditions significant enough to cause manholes to overtop during the peak of the storm according to the drainage model results. Pipe capacity is also a function of the pipe's roughness coefficient (n-value) and its slope. In this case, CMP pipe is relatively rough compared to CPEP pipe, which is typically the preferred material for pipe replacement for projects such as this. The majority of the CMP pipe was also installed at or near minimum slope (0.30%), further decreasing the system's capacity.

   The storm drainage systems that are currently in place were likely sized based on the existing design storms or even older data. Consequently, these systems are not

able to adequately convey the new, more intense Atlas 14 storms. This is demonstrated in the peak flow results and surcharging conditions shown in TABLE 3.

Table 3 - Peak Pipe Flow Summary (Existing System)

Pipe Segment	Pipe Material	Pipe Diameter (in)	Slope (%)	Peak Velocity (ft/s)	Peak Flow (ft^3/s)	Full Flow Capacity (ft^3/s)	Pipe Surcharged
Image Drive System							
I-P-1	CMP	12	0.50%	1.41	1.11	1.38	TRUE
I-P-2	CMP	12	0.20%	2.44	1.92	0.94	TRUE
I-P-3	CMP	12	1.40%	0.56	0.44	2.27	TRUE
I-P-4	CMP	12	0.80%	3.34	2.62	1.72	TRUE
I-P-5	CMP	18	0.50%	1.74	2.58	4.10	TRUE
I-P-6	CMP	18	0.10%	1.89	3.33	2.11	TRUE
I-P-7	CMP	18	0.30%	2.43	4.30	3.33	TRUE
I-P-8	CMP	18	0.20%	2.44	4.31	2.72	TRUE
I-P-9	CMP	18	0.30%	2.45	4.32	3.19	TRUE
I-P-10	CMP	8	0.20%	2.07	0.72	0.31	TRUE
I-P-11	CMP	18	0.50%	3.21	5.67	4.09	TRUE
I-P-12	CMP	12	2.50%	1.35	0.76	3.04	TRUE
I-P-13*	CMP	18	0.20%	3.94	**6.48**	2.78	TRUE
Reflection Drive System							
R-P-1	CMP	12	1.00%	1.25	0.39	1.90	FALSE
R-P-2	CMP	12	0.10%	1.10	0.39	0.73	TRUE
R-P-3	CMP	12	0.70%	1.61	0.88	1.61	TRUE
R-P-4	CMP	12	0.50%	1.82	1.13	1.38	TRUE
R-P-5	CMP	12	1.50%	3.09	1.63	2.37	TRUE
R-P-6	CMP	18	1.00%	2.33	2.33	5.61	TRUE
R-P-7	CMP	18	0.50%	1.77	3.12	4.07	TRUE
R-P-8	CMP	18	0.10%	2.33	4.12	1.62	TRUE
R-P-9	CMP	18	0.50%	3.82	6.75	4.21	TRUE
R-P-10*	CMP	18	0.00%	3.91	**6.89**	0.83	TRUE

*** Pipe Segments I-P-13 & R-P-10 are Outfall Pipes**

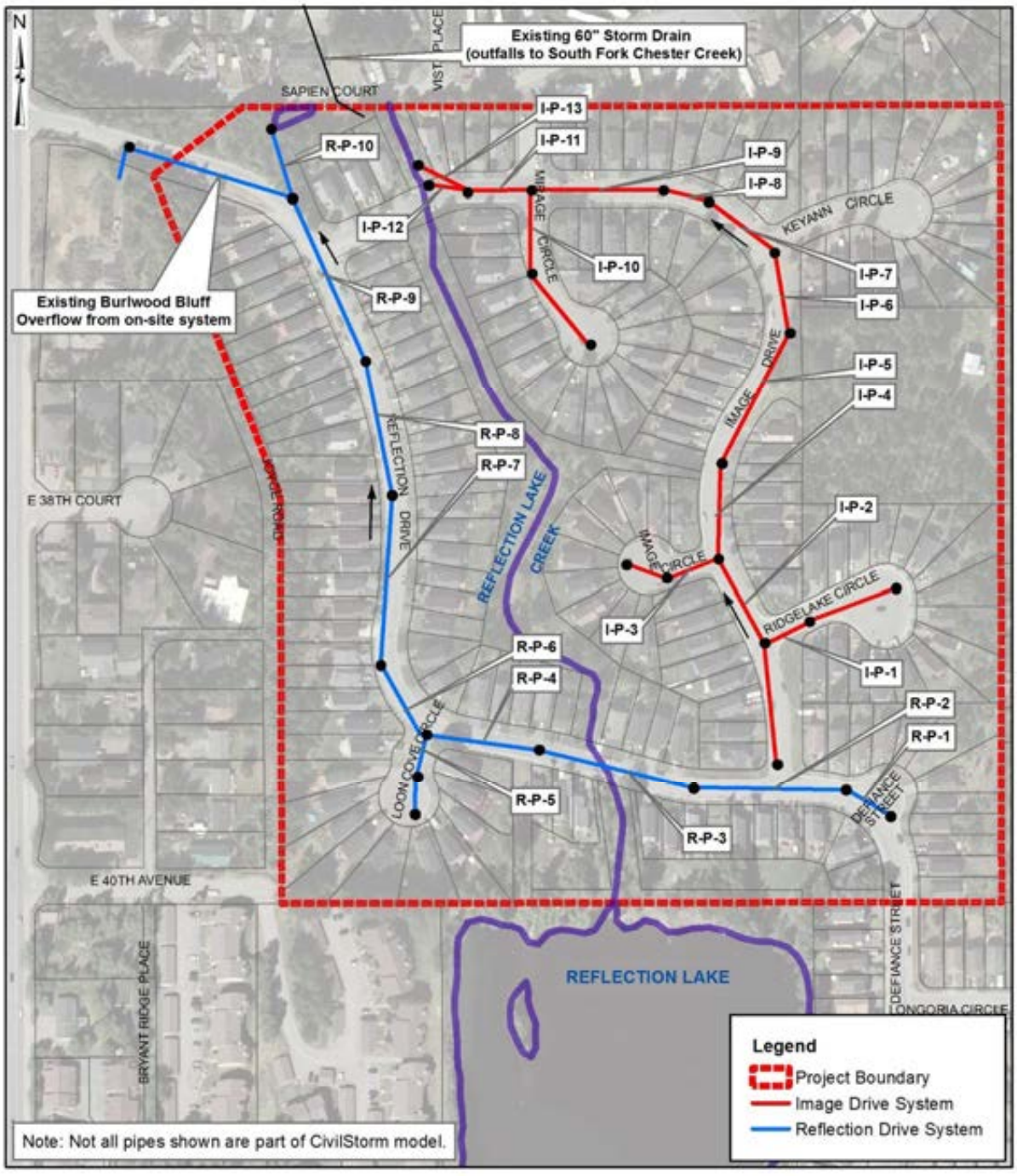


Figure 6 - Existing Storm Drain System

5. Geotechnical Analysis

A. Existing Conditions

Golder conducted the geotechnical field investigation at the end of March 2016; the Draft Geotechnical Report can be found in APPENDIX L. The investigation included drilling and sampling 15 new boreholes to a minimum depth of 15 feet below grade surface (bgs) and ground water monitoring tubes were installed in 10 of the borings. Subsurface conditions encountered along the alignment primarily consisted of sand and gravel with silt to silty sand with gravel fill to depths of about 5 feet, underlain by sand and gravel with varying silt contents. Isolated zones of organic material were observed in several boreholes below the fill material. Based on review of historic geotechnical data in the project area, the fill material was likely imported to the project site after removal of organics from beneath the roadway. Average silt content in the fill material was 12 percent, and ranged from approximately 8 to over 16.5 percent.

At the time of drilling, groundwater was observed in all boreholes excluding BH-01. The depth of groundwater during drilling in BH-02 thru BH-15 varied between 3.7 and 7.5 feet bgs. Water level readings in the piezometers were measured in April, July, and October 2016 (see Table 1 at the end of APPENDIX L for the latest groundwater measurements summary). Note the shallowest groundwater level was recorded at BH-09 and measured 2.9 feet bgs.

B. Potentially Contaminated Soil Investigation

Potentially contaminated soil was encountered during the field exploration at Borehole-08 (BH-08) which was then submitted to SGS North America, Inc. Environmental Services Laboratory (SGS) for further testing. Diesel range organics (DRO) and residual range organics (RRO) were detected in the soil sample, but both were below ADEC cleanup levels. Further investigation was warranted to determine the potential presence of hydrocarbons in the soil that might be encountered during project construction. Golder returned to the site on September 8, 2016 to perform subsurface exploration and collected additional soil and groundwater samples from 5 sites within 300 feet of the BH-08 site at depths ranging from 3 to 12 feet below ground surface. SGS tested the samples for the presence of DRO, RRO, gasoline range organics (GRO), and benzene, toluene, ethyl benzene, and xylenes (BTEX). All laboratory results showed levels of all contaminates were either non-detect or below potential ADEC cleanup levels. See APPENDIX M for the full Chemical Data Report. ADEC was provided a copy of the Chemical Data Report for their reference.

C. Recommendations

In order to provide a roadway structural section that complies with the MOA DCM, a roadway section without insulation would require 10 feet of structural fill. An insulated roadway section would be only 4 feet thick and include:

- 2-inches of asphalt pavement

- 2-inches of leveling course
- 18-inches of MOA Type IIA classified material
- 2-inches of rigid board insulation (R-value = 4.5 Min./Inch of Thickness)
- 24-inches of MOA Type II classified material
- Geotextile (Type A)

A shallower roadway structural section will reduce impacts to existing utilities and adjacent properties during construction. It will also cost less because of the lower quantities for structural fill required. Therefore, an insulated section is recommended for all roadways within the project limits. To reduce potential of curb rolling caused by frost heave, board insulation/structural section should extend a minimum of 3 feet beyond the back of curb where no sidewalk is present or 1foot behind the back of an attached sidewalk. The MOA could consider a reduced structural section on the cul-de-sacs and/or reduce the width of insulation/structural section beyond the back of curb to 1 foot. Both these options reduce the construction cost, but they also increase the risk of future maintenance costs.

Based upon the water level readings, the groundwater table is anticipated to be within or just below the proposed structural section thickness. Therefore it is recommended that the road sections are constructed with subdrains. The best overall drainage in areas of relatively shallow groundwater like at this site is typically provided by subdrains located on both sides of the road and at depths sufficient to maintain groundwater levels below the insulation and to prevent seasonal freezing of the subdrain. However, due to the location of the existing water and sewer mains throughout the project area, there may not be an opportunity to provide two subdrains along all sections of roadway without significant impacts to the existing water/sewer infrastructure. A less costly drainage option that is often used in Anchorage because of funding constraints is a single perforated storm drain located at a varying horizontal location. This section may result in poorer structural section performance over time when compared to the use of dual subdrains but will still be an overall improvement to the current structural section.

A non-woven geotextile should be placed over the excavated subgrade soils prior to placement of classified fill and backfill materials to mitigate impacts of thaw weakening, prevent migration of fines, and promote lateral drainage at the base of the structural section. Fabric should also be extended up the sides of excavations.

Special consideration should be given to transitions between insulated and uninsulated road structural sections. These areas include transitions at the beginning and ending of the project and residential driveway entrances. The insulation should extend out from the roadway section 8 to 12 feet and the thickness reduced in these areas in order to minimize potential for differential heave. The insulation should be tapered from an R-value of 9 to an R-value of 4.5 in the transition zone. Grades and cross-slopes should be maintained within the excavations and fill embankments such that the base and subbase can drain.

The majority of material encountered in the upper 5 feet along the roads are considered frost susceptible. This material does not meet the specification for MOA Type II or Type II-A fill. It is recommended these soils are not reused in the new pavement section.

The recommended structural sections are shown in SECTION 13.

6. Traffic & Safety Analysis

A. Existing Traffic Volumes and Operations

Traffic data was gathered from the Municipality of Anchorage for the project area. Traffic data available in the project area includes:

Table 4 –Traffic Data

Location	Date	Speed	Volume (Link)
Image Drive and Image Circle	7/21/14-7/22/14	X	X
Image Drive and Reflection Drive	7/21/14-7/22/14	X	X
Image Drive and Keyann	8/31/16-9/1/16	X	X
Reflection and Image (North)	8/31/16-9/1/16	X	X
Reflection and Image (South)	8/31/16-9/1/16	X	X

A summary of these studies in detail has been included in APPENDIX E.

B. Traffic Volumes

The existing annual average daily traffic (AADT) volume was determined by using the average of the volume data (link counts) taken during the speed studies and factoring in the seasonal adjustment using the nearest permanent traffic recorder on Tudor Road, west of Tudor Center Drive.

The AMATS regional travel demand model does not include forecasted future daily traffic volumes for residential streets. However, traffic on the residential streets in the project area is not anticipated to increase except when the vacant parcel east of Image Drive and south of Keyann Circle is developed. For the purpose of this study, it is assumed that this parcel will be developed within the next 20 years. This 2.5 acre parcel is zoned R2A with development expected to be approximately 5 homes per acre. The latest edition of the ITE Trip Generation Manual was used to estimate the number of trips generated by development of this parcel. Additional traffic is not anticipated as the area is completely residential, and sees little to no cut-through traffic.

The following table summarizes AADT data for Image Drive and Reflection Drive.

Table 5 - AADT Traffic Data

Roadway	2018 Daily Traffic Volumes	2040 Projected Daily Traffic Volumes
Image Drive	394	540
Reflection Drive	450	600

C. Traffic Characteristics

All streets in the project area are residential and that is not expected to change in the future. As a result, the traffic characteristics are expected to remain unchanged for the life of the project. These characteristics include the design hour volume and directional distribution.

Design Hour Volume is used for capacity and equivalent single axle load computations for roadway sections. The design hour volume was estimated using the 30th Highest Hour of the closest permanent traffic recorder (Tudor Road west of Tudor Center Drive). Directional distribution was estimated using the link counts for the peak hour of traffic. Traffic characteristics are summarized in the following TABLE 6 and APPENDIX E.

Table 6 - Existing and Future Traffic Characteristics

Traffic Characteristic	Project Area
Design Hour Volume	9.5%
Directional Distribution	64/36

D. Speeds

The current posted speed limit for Reflection Drive, Image Drive, and other project area streets is 25 mph. The traffic speed analysis (July of 2014 and August of 2016) conducted by the MOA recorded the 85th percentile speed as follows:

Table 7 - Observed Speeds: 2014-2016

Road Segment	Date	85th Percentile Speed	
		EB/NB	WB/SB
Image Dr. east of Reflection Dr. (North)	7/22/2014	20 mph	21 mph
Image Dr. north of Image Ci.	7/22/2014	20 mph	21 mph
Reflection Dr. south of Image Dr. (North)	8/31/2016	23 mph	22 mph
Reflection Dr. west of Image Dr. (South)	8/31/2016	19 mph	24 mph
Image Dr. South of Kenyann Circle	8/31/2016	19 mph	22 mph

The 85th percentile speed is the speed at which 85 percent of the drivers are driving at or below, and is typically used to determine a reasonable posted speed limit of a roadway. The remaining 15 percent of drivers above the 85th percentile are the minority of drivers who are considered to be exceeding the reasonable speed. Posted speed limits are typically set at the 85th percentile speed. On average, observed 85th percentile speeds in the project area are lower than the posted speed.

E. Crash Data

Crash Data was reviewed for the project area between 2010 and 2015. A total of 2 crashes occurred within the project corridor during this time frame. These crashes both occurred on Reflection Drive. The crash that occurred near the northern portion of the project occurred on Reflection Drive, but ended on Image Drive after the errant vehicle hit a light pole and another vehicle. The following table summarizes the crash type and severity for each crash. A crash diagram is included in APPENDIX E.

Table 8 - Project Area Crash History: 2010-2015

Intersection	Collision Type					Severity					Total
	Angle	Side-Swipe	Rear End	Head On	Fixed Object	Ped/ Bike	Other	PDO	Minor Injury	Major Injury/Fatality	
Reflection Drive	1				1			2			2

PDO = Property Damage Only

Both of these crashes were related to unsafe speeds and do not follow an identifiable pattern.

F. Side Street Intersections/Access Control/Driveways

There are seven street intersections in the project area. These intersections are all stop controlled intersections with the minor approach being stopped and Image Drive or Reflection Drive being the major unstopped approach.

In the project area, Reflection Drive/Defiance Street has 77 residential driveways that have direct access to Reflection Drive/Defiance Street. Image Drive has 51 residential driveways that have direct access. An additional 68 residential driveways connect to the cul-de-sac streets in the project area. These include 17 on Mirage Circle (south), 14 on Keyann Circle, 10 on Image Circle, 16 on Ridgelake Circle, and 11 driveways on Loon Cove Circle.

While driveways accessing directly to the project area streets is expected and anticipated, many of these driveways exceed MOA design standards in width and thereby increasing the potential conflict points on the street. The proposed design should incorporate MOA access standards wherever possible to improve the safety and operations of the corridor.

G. Stopping Sight Distance along Horizontal Curves

A driver's ability to see ahead is required for efficient and safe operation of a vehicle along a roadway. Sight distance of sufficient length should be provided along roadways to allow drivers to control their vehicle and avoid striking an unexpected object in the traveled way. The available sight distance on a roadway should be sufficiently long enough to enable a vehicle at or near the design speed to stop before hitting an object in the roadway. Although lengths of greater visible roadway are desirable, the sight distance at every point along a roadway should be at least that needed for a below-average driver or vehicle to stop.

Stopping sight distance lines of sight along the worst case locations of the horizontal curves within the project limits were drawn in per the guidelines of the MOA PM&E Design Criteria Manual (DCM), see APPENDIX F for the stopping sight distance drawings.

As noted on the drawings, there are various existing trees and features in the ROW that conflict with the stopping sight lines and should be removed or reset out of the sight lines as part of this project.

H. Intersection Departure Sight Triangles

Sight distance is needed at intersections to allow drivers of stopped vehicles at a minor road sufficient view of the intersecting main roadway to decide when to enter the intersecting main roadway or to cross it. If the available sight distance for a minor-road vehicle is at least equal to the required stopping sight distance of the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, a major-road vehicle may need to stop or slow to accommodate the maneuver from the minor-road vehicle. Therefore to provide safe traffic operations, intersection departure sight distances should exceed stopping sight distances along the major road.

The intersection departure sight triangles were drawn in at each intersection within the project area per the guidelines of the MOA PM&E Design Criteria Manual (DCM), see APPENDIX F for the drawings showing the intersection departure sight triangles. As noted on the drawings, there are various existing trees and features in the ROW that conflict with the intersection departure sight triangles. As part of this project, these features should be removed or reset to be outside of the intersection departure sight triangles where feasible. New landscape plantings will be limited to areas not in conflict with the intersection departure sight triangles. Existing features located on private property that conflict with the intersection departure sight triangles are difficult to remove or relocate since these features are outside of the ROW and not owned by the MOA.

7. Design Alternative Analysis

Roadway design plan and profile drawings depicting upgrades to the project roadways can be found in APPENDIX B.

A. Design Challenges

Some of the significant design challenges associated with the Image Drive/Reflection Drive project area include:

- Reflection Lake is located at the southern edge of the project limits and Reflection Lake Creek runs through the project area. The existing storm drain outfalls into the existing creek thus limiting drainage options due to the elevation of the existing creek.
- There are 196 single-family homes in the project area with driveways located closely together. The closely spaced driveways limit available snow storage; MOA Street Maintenance has expressed that the existing space used for snow storage in the project area should not be reduced.
- Many existing driveways have no landings and many have grades steeper than MOA DCM maximum allowable grade of 10%.
- Roadway grades are typically flat, as low as 0.1% percent in some places. 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." Expanding the improvements, such as sidewalks, may be perceived as impacting private property. Also many private improvements extend into the ROW.

Steep driveway and planters in the ROW along Reflection Drive

B. Roadway Cross Section

In order to address the design challenges listed above, it is recommended to minimize impacts to adjacent properties and development. The recommended cross-section for Image Drive and Reflection Drive includes two 11-foot lanes, one 7-foot parking lane (33 feet total width back of curb to back of curb), and one attached 5-foot sidewalk. For the cul-de-sacs at the neck, the recommended cross section includes two 10-foot lanes, one 7-foot parking lane (31 feet total width back of curb to back of curb) and 5-foot sidewalks will only be installed on Ridgelake Circle. The cul-de-sac bulbs will typically match the existing radii except for at Ridgelake Circle where the proposed back of curb will be

narrowed by 1 foot so that the proposed 5-foot wide sidewalk will not impact the existing driveway grades. No roadway lane striping is proposed on any of the roadways.

Based on the project questionnaire responses, adding a sidewalk on both sides of the roadway throughout the project area will not likely be favored by the community. The impacts for additional sidewalks to adjacent developed properties could require re-grading the driveway to garages, additional easements, retaining walls, or other potentially costly measures to avoid impacts to private improvements. The project plans to remove and replace sidewalks in existing locations only except for two additional new locations: a new sidewalk is proposed on the north side of Image Drive from Reflection Drive to Mirage Circle (north) and on the east side of Image Drive from Reflection Drive to Ridgelake Circle. All the proposed sidewalks will be 5 feet wide and attached to the back of the curb. Although this typical section does not meet DCM requirements for number and location of sidewalks, it does improve the existing conditions of the project area and progresses the roadway closer to meet ADA requirements and DCM compliance.

Type 2 rolled curb and gutter is required per the DCM for a “local” road. MOA Title 21.08.050.G differs from the DCM regarding curb and gutter. Title 21 states that curb and gutter shall be the AASHTO vertical type (Type 1 curb and gutter) except for curb and gutter within the arc of a residential scale cul-de-sac shall be Type 2 rolled curb and gutter. Ideally a Type 1 barrier curb should be provided everywhere because it delineates sidewalks better and also discourages parking on the sidewalks compared to a rolled curb. However, due to the existing dense layout of the driveways in the project area, Type 2 rolled curb is recommended for this project. Where feasible, Type 1 barrier curb will be installed where there is an absence of driveways. The recommended typical sections are shown in SECTION 13.

C. Roadway Horizontal Alignment

The paved surface of the existing roadways within the project limits are centered approximately within the ROW. The paved surface of the proposed roadways will be centered in the ROW to minimize overall project impacts.

D. Vertical Alignment

The existing roadway grades of Reflection Drive and Image Drive are typically flat with grades as low as 0.2%. The overall intent of the proposed roadway profile is to increase roadway grades in order to promote positive drainage to storm drain structures while minimizing impacts to driveways and minimizing easements/permits on adjacent properties. As can be expected, there will be more impacts beyond the back of curb or sidewalk the more the roadway grade is changed from the existing grade. Driveways and cul-de-sacs must also be adjusted to match any changes to roadway grades.

Three proposed profile options were investigated for Image Drive/Reflection Drive as explained below:

1. Alternative 1

   This alternative matches the existing flat grades along the roadways which will have the least impact to adjacent driveways and properties. The proposed design results in similar ponding issues in the roadway since grades will be less than the minimum 0.5% required per the DCM. This alternative is not recommended since it does not meet the goals of improving drainage for the project roadways.

2. Alternative 2

   This alternative forces high/low spots by raising the grades to a minimum of 0.5%. This alternative has more impacts to driveways and properties compared to Alternative 1. A 0.5% grade still has a risk of ponding due to being difficult to construct and due to potential settlement issues. This alternative is not recommended because it doesn't provide positive drainage as well as Alternative 3.

3. Alternative 3

   This alternative forces high/low spots and has a minimum grade of 0.65%. This alternative has more impacts to driveways and properties compared to Alternatives 1 and 2 but provides better drainage for the roadways. Even with a minimum 0.65% grade, there is still risk of ponding, but less risk than Alternatives 1 and 2. This alternative also provides positive drainage on all the connecting cul-de-sacs. The minimum proposed cul-de-sac grade is 0.8% which will be provided on Mirage Circle (south). This alternative will require some special fill grading areas be constructed onto property in order to provide positive drainage toward the roadway where the proposed profile grade is raised. The locations where the profile grade is to be adjusted were chosen to try to balance driveway grade changes by not making proposed driveway grades too steep while also maintaining minimum driveway grades in order to ensure positive drainage. The locations where the profile grade is to be raised were chosen in order to minimize impacts to on-property improvements where there will be special fill grading areas required. Even though undesirable, there may be some locations where a storm drain field inlet will need to be installed behind the sidewalk/curb and gutter in order to drain the area appropriately.

Alternative 3 is the preferred vertical profile and is shown on the roadway plan and profile drawings in APPENDIX B.

E. Posted Speed Limit

The DCM recommends that the posted speed limit typically be 5-10 mph lower than the design speed. However, since the 85% percentile speeds currently are less than 25 mph, it is recommended to keep the posted speed at 25 mph.

F. Driveways

There are 196 existing driveways connected to the project roadways. Driveways will need to be reconstructed to match into the proposed roadway design grades. The length of driveway improvements will depend on the proposed grade adjustments required at

each driveway as well as where the proposed footing drain services are to be located. Since many existing driveway widths encompass most of the lot frontage, the proposed footing drain services often times have to be located within the driveway. In such cases this will require replacing the driveway to approximately 5 feet beyond the proposed footing drain service located at the property line.

Closely spaced and steep driveways along west side of Reflection Drive viewing south

Proposed driveway grades were analyzed for the preferred vertical profile and are summarized along with existing grades in APPENDIX G. Proposed plan view driveway reconstruction limits are shown on the roadway plan and profile drawings in APPENDIX B.

G. Drainage Improvements

The drainage analysis discussed in SECTION 4.B.5 identified several deficiencies in the existing Image and Reflection Drive storm drain systems. Most notably, these systems are inadequately sized to convey the design storm event and are corroding. These are the stormwater improvements this project will address, along with other drainage-related issues such as roadway ponding and providing water quality treatment.

The proposed drainage improvements consist of the following:

- Replace undersized and aging CMP systems with CPEP
- Install new subdrain pipe to maximize groundwater removal from roadway structural section
- Replace Reflection Lake Creek culverts in order to install storm drain/roadway improvements
- Provide positive roadway drainage to minimize ponding
- Provide water quality treatment for storm runoff
- Reconstruct sedimentation basin and turn into detention basin
- Provide detention system using oversize pipes to reduce peak flows
- Provide footing drain service stub-outs
- Install a new Lift Station (discussed in SECTION 7.H below)

1. Hydrologic and Hydraulic Model Results

   In order to properly size the proposed conveyance systems, a hydrologic and hydraulic (drainage) model was evaluated for the proposed conditions. A total of 19

contributing catchments were delineated and evaluated for runoff response for the proposed condition. The majority of the catchments remained unchanged from the existing condition. However, Catchments R-8 and R-9 from the existing condition were revised to I-9 and I-10, respectively. These two catchments currently contribute runoff to the Reflection Drive system. The proposed design intends to intercept these flows via the Image Drive system to utilize the detention system as effectively as possible. Additionally, a new catchment was included in the proposed drainage model, denoted CM-1, to account for anticipated runoff from the East 40th Avenue area. The MOA PM&E Loon Cove Drainage Improvements project (Project no. 13-59) plans to redirect flows from East 40th Avenue to the storm drain system located in Loon Cove Circle. These flows will contribute to the proposed Reflection Drive system. Refer to SECTION 2.A.4.B) for additional information on this project. Catchment input parameters and peak runoff from each catchment during the 10-year design storm is summarized in Table 3 and 4, APPENDIX H.

Peak pipe flows for the proposed drainage systems are provided in TABLE 9 below. Refer to FIGURE 7 below to correlate the location of each pipe segment with TABLE 9.

Table 9 - Peak Pipe Flow Summary (Proposed Condition)

Pipe Segment	Pipe Material	Pipe Diameter (in)	Slope (%)	Peak Velocity (ft/s)	Peak Flow (ft^3/s)	Full Flow Capacity (ft^3/s)	Pipe Surcharged
Image Drive System							
I-P-1	CPEP	18	-0.30%	1.87	0.40	6.25	FALSE
I-P-2	CPEP	18	-0.30%	2.20	0.67	6.23	FALSE
I-P-3	CPEP	12	2.80%	6.23	1.27	6.40	FALSE
I-P-4	CPEP	18	0.50%	4.15	2.78	8.28	FALSE
I-P-5	CPEP	12	1.50%	1.22	0.46	4.66	FALSE
I-P-6	CPEP	18	0.50%	4.36	3.64	7.99	FALSE
I-P-7	CPEP	18	0.60%	4.63	3.64	8.77	FALSE
I-P-8	CPEP	18	0.30%	3.84	4.31	5.92	FALSE
I-P-9	CPEP	18	0.50%	5.01	5.57	8.34	FALSE
I-P-10	CPEP	18	0.60%	4.51	5.58	8.87	FALSE
I-P-11	CPEP	18	0.30%	4.03	6.22	6.22	FALSE
I-P-12	CPEP	12	0.60%	2.93	0.74	2.86	FALSE
I-P-13	CPEP	18	0.30%	4.31	6.86	6.25	FALSE
I-P-14	CPEP	24	0.10%	2.23	6.82	5.48	FALSE
I-P-15	CPEP	10	6.00%	12.48	6.81	5.81	TRUE
I-P-16	CPEP	18	0.30%	4.39	6.80	6.20	FALSE
I-P-17	CPEP	18	0.30%	4.58	7.18	6.22	FALSE
I-P-18	CPEP	18	0.30%	5.04	7.18	6.20	FALSE
Reflection Drive System							
R-P-1	CPEP	18	0.30%	0.00	0.00	6.23	FALSE
R-P-2	CPEP	18	0.30%	1.65	0.27	6.26	FALSE
R-P-3	CPEP	12	12.40%	13.94	3.11	13.60	FALSE
R-P-4	CPEP	18	0.30%	3.71	3.27	6.27	FALSE
R-P-5	CPEP	18	0.30%	3.71	3.78	6.23	FALSE
R-P-6	CPEP	18	0.30%	3.92	4.62	6.23	FALSE
R-P-7	CPEP	24	0.30%	5.49	13.93	13.42	FALSE
R-P-8*	CPEP	24	0.30%	5.98	**14.06**	13.37	FALSE
E. 40th Ave / Loon Cove Circle Connection (Improvements by Others)							
LC-P-1	CPEP	12	6.70%	9.79	1.98	9.98	FALSE
LC-P-2	CPEP	12	26.40%	11.48	1.98	19.82	FALSE
LC-P-3	CPEP	12	2.60%	6.97	1.98	6.20	FALSE
LC-P-4	CPEP	12	1.60%	5.85	1.97	4.94	FALSE

*** Pipe Segment R-P-8 is an Outfall Pipe into proposed lift station**

TABLE 9 indicates surcharging conditions for pipe segment I-P-15. The upstream pipe segment, I-P-14, was modeled to represent the 24-inch oversized pipe gallery (6 barrel, 100' length manifold system) located along the dead end street north of Mirage Circle. Pipe segment I-P-15 was modeled to represent the flow control structure (with 10-inch diameter orifice) downstream of the oversized pipe gallery. The oversized pipe gallery and flow control structure are designed to temporarily detain runoff to reduce peak flows into the lift station. The surcharging condition for pipe segment I-P-15 is a result of the flow control structure backing up flow into the oversized pipe gallery and maximizing its available volume as it is intended to do. An overflow weir will be included in the flow control structure to convey flows

downstream once the detention system is completely filled in the event runoff exceeds the 10-year design storm. Pipe segment R-P-8 combines flows from the E. 40th Avenue system (by others), Image Drive system, and Reflection Drive system and outfalls into the proposed lift station located at the intersection of Image and Reflection Drive.

For comparison purposes, peak pipe flows for the existing and proposed drainage systems at each outfall location are summarized in TABLE 10 below. Based on these results, the drainage model predicts a peak flow increase of approximately 4.9% from the existing to proposed condition. The peak flow increase is, in part, due to additional runoff contributed from the proposed East 40th Avenue storm drain system (by others). This runoff is conveyed to Reflection Lake in the existing condition.

Table 10 - Existing & Proposed Peak Runoff

Outfall Location (Pipe Segment)	Existing 10-year, 24-hour Storm Event (cfs)	Proposed 10-year, 24-hour Storm Event (cfs)
Existing Condition		
Reflection Drive (R-P-10)	6.89	-
Image Drive (I-P-13)	6.48	-
Combined Peak Flow	**13.37**	-
Proposed Condition		
Lift Station - Reflection & Image Drive Combined (R-P-8)	-	**14.06**

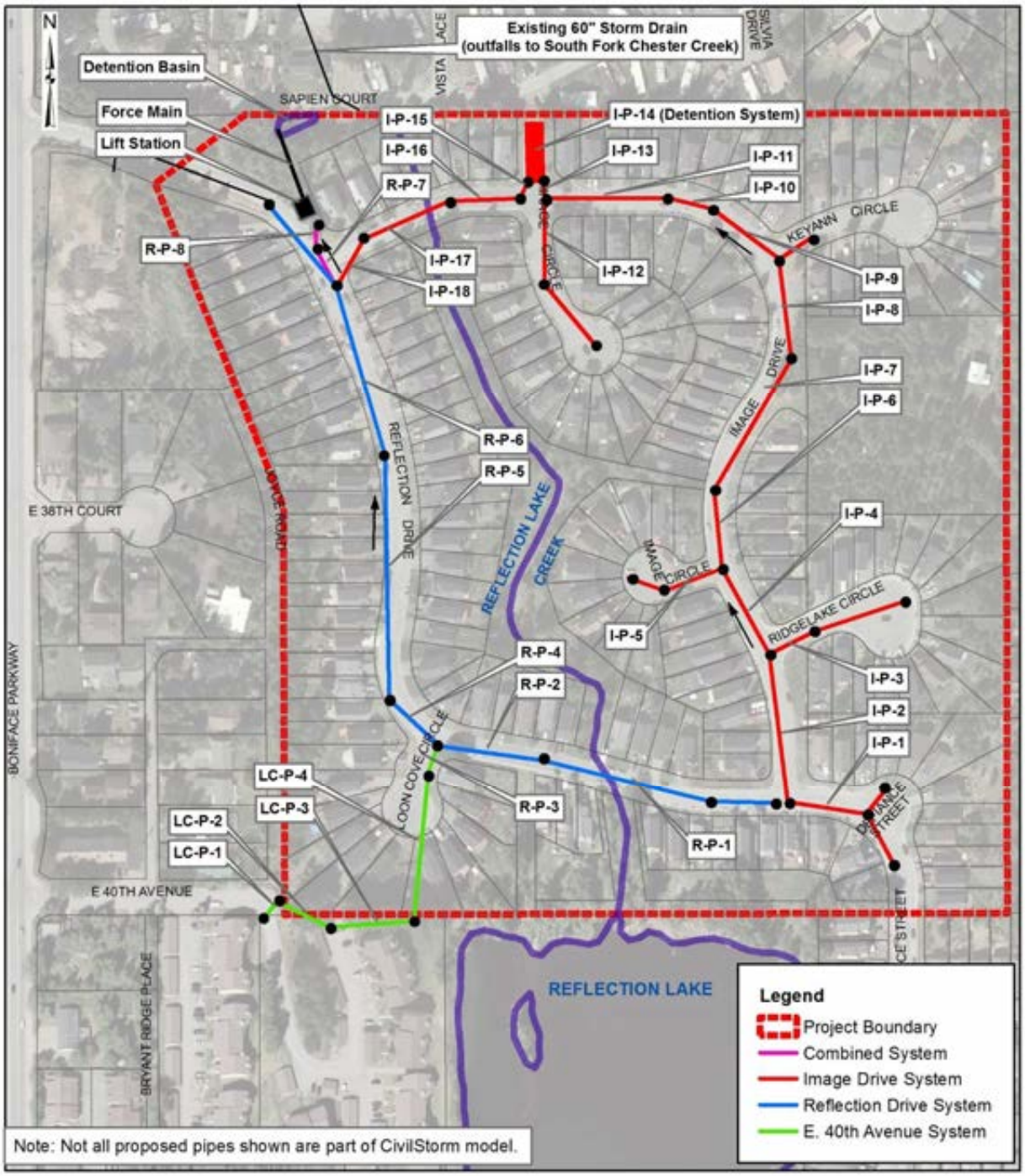


Figure 7 - Proposed Storm Drain System

The 90th Percentile, 24-hour storm was also modeled for water quality treatment design purposes. The results from this storm event will be used to size to stormwater controls that will meet water quality treatment requirements, which are discussed in more detail in Section 7.G.5.

2. Replace Existing Drainage Systems - Image and Reflection Drive

   The drainage improvements for this project will include removing and replacing pipe and structures. The proposed storm drain improvements will upsize all pipes except catch basin leads to minimum 18-inch CPEP, Type SP (perforated). Catch basins leads will be 12-inch CPEP, Type S (non-perforated). CPEP is constructed of polyethylene and is corrosion resistant material. Additionally, CPEP has a much lower roughness factor than CMP (CPEP n-value = 0.012 vs. CMP n-value = 0.024), resulting in improved hydraulic capacity.

   The optimal storm drain configuration is to install perforated pipe (subdrain) on both sides of the roadway at the bottom of the structural section per geotechnical recommendations. However, due to the curvilinear nature of Image and Reflection Drive and the location of existing water and sewer utilities, this configuration is not always feasible. In locations where new dual subdrains cannot be installed, a single subdrain will be installed along the center of the roadway (or as close as possible), while still maintaining appropriate separation distances from water and sewer mains. To maximize groundwater removal within the roadway structural section, the proposed subdrain will be located near the bottom of the structural section.

   The proposed storm drain layout is shown on the storm drain plan and profile drawings in APPENDIX C.

3. Replace Reflection Lake Creek Culverts

   The existing 24-inch CPEP and 36-inch CMP culverts that cross both Image and Reflection Drive will need to be removed to construct the proposed storm drain system and reconstruct the roadway. Both crossing locations will be reconstructed based on the same design provided for the MOA PM&E Riviera Terrace Storm Drain Replacement project (Project No. 08-48) installed in 2013. This reconstruction will include replacing stream substrate material in 36-inch CMP and the heat trace systems associated with each culvert.

4. Minimize Ponding

   The proposed roadway profile is designed to establish high and low points in locations with little or no grade. These high and low points are used to direct roadway runoff to curb inlets. The curb inlets capture curb flow and direct runoff to the storm drain system, eliminating standing water. These improvements will help alleviate ponding issues along the entire project limits.

   The roadway profile and curb inlet locations area shown on the storm drain plan and profile drawings in APPENDIX C.

5. Water Quality Treatment

   The new permit requirements referenced in SECTION 4.A.4 state that stormwater management systems are to be designed to provide water quality treatment through the use of Green Infrastructure (GI) whenever feasible. GI treatment techniques

include methods such as retention, infiltration, bioretention, evaporation, and/or any combination of these techniques.

Section 3.3.2.1 of the ASM also states that roadway projects within narrow ROW (60-feet or less) may choose to provide stormwater treatment through either GI or traditional treatment, regardless of site constraints. This project meets this criterion, but also intends to provide treatment through GI where possible.

The proposed improvements will implement an oil and grit separator (OGS) for water quality treatment upstream of the proposed lift station, located near the intersection of Image Drive and Reflection Drive. The OGS will be sized to treat the first 0.52 inches of rainfall from a 24-hour event, also referred to as the 90th Percentile storm. A bypass system will be provided to convey flows around the OGS for maintenance purposes.

In addition to the OGS, an existing sedimentation basin downstream of the lift station will be reconstructed as a detention basin and will also provide some additional treatment. The current sedimentation basin will be reconfigured and resized based on the lift station discharge rates and outfall location. The outfall pipe connecting the basin to the downstream manhole will be replaced and designed to maximize runoff detention time within the basin, while conveying flows downstream during larger storm events.

The upstream OGS will also serve as pre-treatment for the lift station and detention basin by removing floatable pollutants such as trash, oil, grease, and sediment.

The proposed detention basin improvements will include a fence & warning signs surrounding the basin to discourage unwanted access. An access gate will be installed on north side of the basin for maintenance access from Sapien Court. A maintenance access agreement with the Riviera Terrace Tralier Court property to the north may already be established to access the existing storm drain that currently crosses their property. If not, the Image and Reflection project will seek an access agreement in order to accomplish future detention basin and storm drain maintenance.

6. Peak Flow Reduction

   An oversized pipe system, sometimes referred to as a pipe gallery, is proposed at the current dead end road of Mirage Circle (north). This type of system is designed to reduce peak flow rates by providing temporary, subsurface storage of stormwater runoff. Essentially, this system consists of a series of interconnected large diameter pipes with a small outlet at its invert. For this project, the pipe gallery will discharge into a downstream manhole that is configured with a small diameter orifice and an overflow weir (flow control structure) to convey larger storm events.

   The proposed pipe gallery consists of six, 24-inch diameter CPEP pipes interconnected by a manifold pipe at one end. Each 24-inch pipe will be set at minimum slope (0.30%) to maximize detention volume. For maintenance, access

ports at each of the pipe gallery will be provided to flush any sediment towards the low end of the pipe gallery, where it can be removed by a vactor truck.

The configuration of the oversized pipe gallery is shown on Sheet SD1 of the storm drain plan and profile drawings in APPENDIX C.

7. Footing Drain Services

   Footing drain services are to be installed up to the property line for every parcel in the project area. There are a total of 196 homes that will be served. Footing drain services are used to drain unwanted water from crawl spaces into the storm drain system.

   Footing drain services will be constructed of 6-inch CPEP (Type S). Services will connect to the storm drain piping with a saddle type connection and will extend up to property line. If an existing footing drain is present on-property, the new footing drain service pipe will be reconnected to the on-site piping. In locations where no footing drain is currently present, footing drain pipe will be capped at property line for future connection by homeowner.

H. Stormwater Lift Station

In order for the proposed subdrains to be located beneath the proposed structural section, the subdrain pipes will need to be installed lower than the existing storm drain outfall elevations to Reflection Lake Stream.

An alternative design to install a new gravity outfall storm drain pipe from Image Drive north through the Riviera Terrace Trailer Court and outfall directly into South Fork of Chester Creek was also investigated. The proposed pipe would parallel the recently installed 60-inch diameter pipe and manholes that were installed as part of the 2013 Riviera Terrace Storm Drain Replacement project. Even though this option may be technically feasible, it was determined that this option was not desirable due to significant impacts to existing mobile homes and additional easement requirements on the Riviera Terrace Trailer Court property. It also would require the outfall pipe into South Fork of Chester Creek to be partially submerged which is not allowed per the ASM. Therefore, a stormwater lift station is recommended to make up the difference in elevation and allow for the subdrains to be installed beneath the structural section. The lift station will also alleviate the existing submerged storm drain outfall that discharges into Reflection Lake Creek from the Image Drive storm drain system. Installing a separate lift station for each existing storm drain system was investigated but was determined to not be as cost effective.

As mentioned previously, one of the goals of the drainage design is to minimize downstream impacts to existing facilities. In order to accomplish this goal, this project proposes to construct a new detention basin downstream of the lift station. The detention basin will replace the existing sedimentation basin located just south of Sapien Court. The discharge from the detention basin will be restricted to mitigate the relatively high flows from the lift station from being directly discharged to the creek and overwhelming

the downstream storm drain line. The detention basin will be sized to provide storage for excess flows from the lift station during the design storm event.

1. Lift Station Location & Force Main Analysis

   Two potential lift station sites were evaluated including potential force main routes from each site. See

   FIGURE 8 below for plan view layout of each alternative.

   a) Alternative A - Mirage Circle (North) Dead End

   The Alternative A lift station site is located in the ROW north of Mirage Circle on a paved segment of a dead end road. This location is easily accessible for maintenance from Image Drive, doesn't require significant site work or any utility relocations for construction, and all work could be completed within the existing ROW. However, Site A will only allow limited upstream detention pipes in this area when compared to the Alternative B site. The storm drain detention pipes will retain some of the stormwater flow and reduce the peak volume draining to the lift station. This will reduce the required size of the lift station wet well and pumps. The closest home is approximately 25 feet from the location of the proposed Alternative A lift station site.

   Multiple force main routes were investigated from Site A including:

   1. Route the force main to the north into the Riviera Terrace Trailer Court and discharge into the existing 60-inch storm drain line that was installed during the 2013 Riviera Terrace Storm Drain Replacement project.
   2. Route the proposed force main to the north and west along the back of Parcels 114-117 and outfall into Reflection Lake Creek.
   3. Route the force main south and then west along Image Drive until reaching Reflection Drive. From Reflection Drive the proposed force main would be routed toward the north and then outfall into the proposed detention basin.

   Routes 1 and 2 above are not desirable because the force main outfall wouldn't utilize the proposed detention basin which is necessary to use in order to avoid negative impacts to downstream drainage facilities.

   Route 3 is the preferred option for the force main alignment from the Alternative A site. The length of the proposed force main will be approximately 620 feet. The force main will not be able to be sloped completely downward such that the force main drains completely into the detention basin between pumping cycles. Therefore additional force main frost protection measures such as arctic pipe with electric heat trace would be required.

   b) Alternative B – Northeast Image Drive/Reflection Drive Intx.

   The Alternative B lift station site is located in the ROW at the northeast quadrant of the Reflection Drive/Image Drive intersection. This location is easily accessible for maintenance personnel from Reflection Drive. This site will require removing

and relocating a fire hydrant, approximately 95 feet of water main and reconnecting three existing water services. Construction of this alternative will require a small public use easement and a temporary construction easement from Parcel 121. The Alternative B site allows additional storm drain detention pipes within Mirage Circle (north) compared to the Alternative A site which helps reduce the peak stormwater volumes at the lift station. The home on Parcel 121 is approximately 21 feet from the proposed site.

The force main alignment from Alternative B site would be routed northwest approximately 150 feet to the proposed detention basin. The force main can be installed to be sloped downward such that the force main drains completely into the detention basin between pumping cycles.

Both the lift station location alternatives were presented to MOA Watershed Management, MOA Street Maintenance & the MOA Flood Plain Administrator and both options were considered acceptable. In order to determine the preferred location, the two alternatives were evaluated based upon various design factors. The following TABLE 11 presents a matrix of the design factors using a rating scale. Based upon the matrix results, the preferred location is Alternative B. Conceptual plans and details of the proposed lift station can be found in APPENDIX N.

Table 11 - Lift Station Location Alternatives Matrix

	Location Alternative	
Design Factor	**A**	**B**
Access	2	2
Required Site Work	1	1
Length of Force Main	0	2
Force Main Drainage	0	2
Upstream Detention of Stormwater Flows	1	2
Depth of Lift Station Excavation	1	2
Impacts to Utilities	2	0
Easement Requirements	2	1
Distance from Existing Homes	2	1
Cost	1	1
Total	**12**	**14**

Rating Scale:

0 Poor (worst)
1 Moderate
2 Good (best)

Figure 8 – Lift Station Alternate Locations & Force Main Alignments

2. Control Panel

   The lift station will be equipped with programmable controls which will allow automatic and manual operation of the pumps, generate alarms, and control other miscellaneous lift station equipment like lights and electric heat trace. Lift station alarms will consist of low and high levels, low temperature, power failure, pump failure, surge suppressor failure, and phase converter failure. An automatic alarm dialer can be installed if requested by MOA to identify the lift station to notify MOA Street Maintenance of an emergency.

   The installation of pumps larger than 5-horsepower requires three-phase electrical power to the pumps. The nearest three-phase power is located along Boniface Parkway approximately 550 feet northwest of the preferred lift station location. Extending three-phase power to the preferred location is estimated to cost approximately $100,000. This cost has been added into the construction cost estimate.

3. Pump Sizing

   MOA design criteria requires a minimum of two pumps in the lift station. If only two pumps are used, each pump would be required to be able to pump the 5-year design storm event flow rate of 3,750 gpm. Both pumps together would need to be able to pump the 10-year design storm event flow of 6,000 gpm. By installing three pumps, each pump can be smaller with two pumps used to meet the 5-year storm event flows and the third pump used during the 10-year design storm event. In addition, pumps require a higher electrical load to start than when they are running. Repeated starts in a short time frame can damage pump motors and good design practice limits the number of starts per hour to six. A major component in sizing the lift station wetwell is limiting pump starts so installing smaller pumps also allows the wetwell to be smaller. Therefore, to allow a smaller and more efficient lift station, three pumps are proposed for this project.

   Pump output is variable depending on the headloss observed in the downstream piping. Higher flow rates result in larger losses due to increased friction in the downstream pipe. The three pump system is sized to meet the requirements of 10-year design storm event output of 6,000 gpm. During smaller events, only one or two pumps are needed so the headloss in the downstream piping is less and individual pump output could be higher. To avoid excessive pump starts the output of each pump will be limited to 2,000 gpm by utilizing variable frequency drives (VFD's) to modify the pump motor output. Initial pump sizing indicates that each pump will need to have a 30 Hp motor. Pumps will be controlled by a lead / lag operation with automatic alteration between pump cycles.

4. Lift Station & Force Main Sizing

   The required size of the lift station wetwell is determined by:

   - Pump output capacity
   - Limiting the number of pump starts per hour
   - Required storage volume during design storm event

   Typically, the design approach is to minimize the size of the lift station wetwell to reduce construction costs. The pumps are therefore designed to match the modeled input from the 10-year design event (input equals output) and storage within the wetwell can be eliminated. Wetwell volume therefore becomes primarily dependent on providing enough storage to limit the number of pump starts per hour given the pump output necessary for the design storm event.

   On this project, upstream detention of stormwater flows is being provided which helps reduce the peak flows entering the lift station during the 5-year design storm event, but not the 10-year event. This upstream detention allows the pump size to be reduced and, as a result, reduces the required volume of the wetwell.

   The presence of groundwater at relatively shallow depths within the project area will make any excavation challenging. Limiting the depth of the wetwell will reduce

excavation requirements and minimize dewatering efforts during construction which will both help reduce project costs. Limiting the depth means that the cross section of the wet well must be increased to provide the necessary pump working volume. Several cross sections were evaluated and the selected wetwell size was a 20-foot long by 20-foot wide square vault.

APPENDIX N provides a summary of the spreadsheet that was developed to review the impacts of various pump outputs and wet well depths to optimize the system. The selected layout lead pump sensor will be installed 3.5 feet above the pump shut-off sensor, and the lag pump sensor will be installed 1.5 feet above the lead pump sensor. The third pump will be triggered to turn on 6-inches above the lag pump. A high water float will be installed 6 feet above the pump shut-off sensor to signal an alarm in the event of flooding. The wet well will have a total depth of 21 feet with the bottom foot reserved for sediment storage. The total capacity of the wet well from the pump to the high water alarm is 2,400 cubic feet.

5. Lift Station Installation

   Due to the depth of the lift station and the goal of trying to protect the existing home and utility infrastructure, it is recommended to install four sheet pile walls to provide the outer forms for the concrete lift station. The material within the walls will be excavated and then the rebar and forms will be set inside the walls and the concrete poured. Due to the high groundwater in the area, the existing groundwater depth around the adjacent home will need to be maintained in order to not adversely affect the homes foundation.

   It is recommended to drill another soil boring at the preferred lift station location to a depth of approximately 3 times the depth of the proposed lift station. This will enable the geotechnical engineer's to analyze the conceptual lift station installation technique of installing the sheet pile walls. If the boring shows that large boulders or very stiff material is present, this installation technique may not be feasible. An additional piezometer should also be installed in the new boring in order to monitor the groundwater throughout the year. The geotechnical engineer will also be tasked with providing recommendations for dewatering during the lift station installation.

   The existing home on Parcel 121 should be inspected during design development in order to verify that the home is constructed of materials that can withstand the sheet pile wall installations.

I. Mirage Circle (north)

Mirage Circle (north) is located north of Image Drive across from Mirage Circle and is a dead-end roadway with no driveways connected to it. A connection from Mirage Circle (north) to the property to the north is not anticipated. Instead of reconstructing the roadway to its current width of 33 feet (measured from back of curb to back of curb), it is recommended to reconstruct Mirage Circle (north) as a 26-foot wide strip paved roadway in order to provide maintenance access to the proposed pipe gallery cleaning access points located at the north side of the roadway. Reconstructing this roadway will also

allow continued use of on-street parking which was requested by residents during the public open house.

J. Traffic Calming

Speeding is a concern for residents, however the speed study as summarized in SECTION 6 showed that 85th-percentile speeds throughout the project roadways are typically below the posted 25 mph speed limit.

Traffic calming measures are employed on roadways with the intention of slowing down vehicle traffic. Traffic calming helps improve safety of both motorists and pedestrians on the roadway. The following traffic calming methods were investigated for use on this project.

1. Traffic Calming Methods

a) Neckdowns

Neckdowns (also commonly referred to as "bulb outs") are curb extensions at intersections that reduce roadway widths from curb to curb and visually break up a long straight curb line. However, neckdowns may restrict vehicles with large turning radii from making maneuvers in or out of side streets without forcing encroachment into the opposite traffic lane. If these types of vehicles are expected to frequently make maneuvers onto side streets then larger curb returns and wider side street widths may need to be incorporated. Neckdown lane widths are typically 11 feet measured from the centerline to lip of curb. Neckdowns reduce the total length of pedestrian crossings. Roadway shoulders or parking lanes are eliminated at the neckdown. Neckdowns are typically not recommended with a curved roadway alignment.

b) Center Island Narrowing

Placing a center island in the street will deflect traffic to the right around the island and provide a short interruption in an open street. If the center island has sufficient width it can be landscaped. A center island can also mitigate large grade differences across roads and can be utilized to improve drainage in low lying areas. Inadequate ROW or roadway width could limit the use of center islands.

Colored crosswalks on E. 4th Avenue at Camelot Drive

c) Colored Concrete Crosswalks

Colored concrete crosswalks can be used for crosswalks at higher volume side streets and in conjunction with other traffic calming measures. Colored concrete crosswalks provide additional visual guides

for motorists and allow for a safer crossing. However, the cost to install colored concrete is very expensive.

d) Voluntary Speed Compliance Signs

A voluntary speed compliance sign is a temporarily or permanently mounted sign display that measures the speed of the traveling vehicle and displays the numerical speed to the driver. When measured vehicle speeds violate the speed limit, the display flashes to alert the driver. The MOA Traffic Engineering Division has recently installed battery-operated signs at select locations within the Municipality to test their effectiveness of reducing traffic speeds.

e) Speed Humps, Raised Intersections, Speed Tables, Raised Pedestrian Crosswalks & Speed Cushions

Speed humps are short, vertical humps installed in the roadway to reduce traffic speeds. The MOA has a program in place where residents can petition to have speed humps installed in their neighborhoods. Speed humps are not recommended on primary emergency routes or bus routes. There are two existing speed humps currently installed on Reflection Drive and two speed humps currently installed on Image Drive.

Raised intersections are flat elevated areas covering the entire intersection with ramps on all approaches. Vehicles entering the intersection are required to slow down before negotiating the ramp leading up to the intersection.

Speed tables are flat-topped speed humps with ramps. They are typically long enough for the entire wheel base of a passenger car to rest on top.

Raised pedestrian crosswalks are speed tables marked for pedestrian crossings. They require reduced vehicle crossing speeds and give higher priority to pedestrian crossing movements.

Speed cushions are speed humps with wheel cutouts to allow emergency vehicles to pass unaffected while still reducing passenger car speeds. MOA Traffic is planning to install speed cushions in lieu of traditional speed humps in several locations in Anchorage in 2018.

2. Proposed Traffic Calming

Currently there are four existing speed humps in the project area and it is unknown what the 85th-percentile speeds were before installation of the speed humps. The Traffic Calming Manual published by MOA in 2005 states that before installation of speed humps will be considered, one of the following criteria must be met:

- 500 vehicles per day average daily traffic and 85th-percentile speed greater than 25 mph or
- Less than 500 vehicles per day and 85th-percentile speed greater than or equal to 30 mph

Currently, neither of these criteria is met – the AADT is less than 500 and the 85th-percentile speed is below 25 mph, although the impact of the existing speeds humps on the 85th-percentile speed is unknown. Based on a comment received from the survey questionnaire, a resident of the neighborhood advocated for installation of the speed humps that are currently installed.

Since the Traffic Manual was published in 2005, additional studies and concerns have been raised regarding speed humps. Specifically, speed humps delay the response of emergency vehicles including fire trucks, police vehicles, and ambulances.

Since it is often difficult to remove existing traffic calming measures without receiving negative feedback from residents and because the 85th percentile speed is lower than the speed limit, the speed humps are proposed to be re-installed at the same locations as the current ones. An alternate option to reduce delay response of emergency vehicles would be to install speed cushions instead of speed humps. This option will be explored with the MOA Traffic Department during the detailed design of the project. The location of the proposed speed humps are shown in SECTION 13 on FIGURE 11.

K. Mailboxes

Residents along Reflection Drive, Image Drive and all cul-de-sacs excluding Keyann Circle have cluster mailbox service. Residents along Defiance Street (east of Image Circle) and on Keyann Circle have individual mailbox service. Cluster mailboxes are desirable to the MOA and United States Postal Service (USPS) as they facilitate maintenance, reduce delivery times, and provide a secure receptacle for residents. Another advantage of cluster mailboxes when sidewalks are present is they can be placed behind the sidewalk instead of an individual mailbox being placed in the sidewalk. Mailboxes placed in the sidewalk are a safety hazard for pedestrians and hinder snow removal.

Existing cluster mailboxes on Reflection Drive and individual mailboxes on Defiance Street

Existing cluster mailboxes will likely be re-installed on concrete bases in approximately the same locations. Cluster mailboxes are often installed behind an attached sidewalk or back of curb as the postal carrier must already exit the vehicle to deliver mail.

USPS Muldoon Postmaster was contacted during the Draft DSR development in order to determine whether USPS would be in support of moving the individual mailboxes in the project area to cluster mailboxes. USPS stated that they would explore the option in more detail during the design phase. A recent change from USPS regarding cluster mailboxes is that they will now require the MOA to purchase the cluster mailboxes as well as install the concrete pad if the MOA desires to relocate the individual mailboxes to cluster mailboxes. Previously the USPS had procured the cluster mailbox.

If USPS supports relocating the individual mailboxes to cluster mailboxes, residents with individual mailboxes will be contacted during the design phase to gauge the acceptability of switching to cluster mailboxes. If individual mailboxes are replaced where a sidewalk is proposed, the sidewalk will need to be separated from the curb in those locations by a minimum of 3 feet so that the mailbox can be installed between the curb and the sidewalk. Existing individual mailboxes will be re-used where reasonable. If the existing mailboxes do not meet current postal standards they will be replaced with new boxes that meet current standards. If cluster mailboxes are elected, the design team will work with the USPS and residents to determine appropriate installation locations.

L. Lighting

The proposed lighting system for the Image Drive / Reflection project area will include 30-foot tall rounded street poles mounted on driven steel pile foundations. Per Chapter 5 of the DCM, in low-speed urban areas like the Image and Reflection Drive area, luminaire pole bases should be fixed base (i.e. non-breakaway). This is because the impact on a vehicle and its occupants with a fixed base at low speeds is considered less hazardous than the potential harm from falling (breakaway) poles.

The system also will include energy efficient LED luminaires that provide a full cutoff light distribution. Where feasible, the poles will be located at property lines to reduce the light trespass into adjacent homes located on each parcel. The lights will also be equipped with backlight shields in order to minimize light trespass behind the lights. Light levels and uniformity ratios for road, pedestrian facilities, and at intersections per Chapter 5 of the DCM are summarized below:

1. Roadway (not including intersections)

   For a local roadway with low pedestrian activity, such as the roadways in the project area, 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.

2. Pedestrian Facilities:

   Pedestrian activity within the project area meets the “low” criteria provided in Chapter 5 of the DCM. For adjacent pedestrian facilities within the low pedestrian volume

criteria, Chapter 5 of the DCM includes three light level requirements based on land use: rural/semi-rural, low-density residential, and medium-density residential. In areas with medium-density homes such as the project area, a minimum maintained average of 0.4 foot-candles with an average-to-minimum uniformity ratio no greater than 4:1 is required.

3. Intersections:

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

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

   The TABLE 12 below is from the DCM Table 5-5 and is based upon the ADT roadway classifications:

Table 12 - Illuminance for Intersections

Functional Lighting Classification	Average Maintained Illuminance (low pedestrian area)	Maximum Uniformity Ratio
Major/Major	1.8	3.0
Major/Collector	1.5	3.0
Major/Local	1.3	3.0
Collector/Collector	1.2	4.0
Collector/Local	1.0	4.0
Local/Local	0.8	6.0

For the design year AADT, all roadways in the project area are classified as Local roads. Roadway lighting between intersections will meet the DCM requirements for a local low-speed urban road with low pedestrian activity.

M. Heat Trace

Heat trace will be re-installed in each of the culvert pipes at both the Image Drive and Reflection Drive stream crossings as well as in Reflection Lake Creek at the inlet and outlet of the culverts. New heat trace will be installed at the force main outfall, along the detention basin and in the pipe that outfalls from the detention basin to the existing storm drain system. The intent of the new heat trace is to minimize glaciation at the lift station outfall & ensure an open drainage path during the winter months.

N. Landscaping

Per Section 3.3A of the MOA DCM, existing plant material will be protected to the greatest extent possible. Trees and shrubs affected by construction will be reviewed on a case by case basis. An on-site conference with MOA staff, the Contractor and the Engineer shall take place prior to construction in order to establish a tree protection zone (TPZ) around existing mature plants that are outside the impacts of construction and are to be protected in place. The goal of establishing the TPZ is to ensure that the critical root zone of the trees and shrubs are not damaged or compacted during construction. This will provide the trees and shrubs the best conditions to survive.

Due to limited ROW it is to be expected that new landscape plantings will be minimal. A minimum seven-foot lawn buffer at the back of curb or back of sidewalk shall be located where space allows, providing for snow storage along the length of the roadway. Landscaping should be placed at the outside edge of the right-of-way adjacent to property lines, but away from utilities, and in locations that are not in conflict with departure sight triangles as defined in the DCM.

When providing new plant material for the project, only species hardy to the Anchorage Bowl will be selected and used. All plant material provided will be installed per Municipality of Anchorage's Standard Specifications (MASS) Division 75 Landscaping Improvements. Moose protection fencing will be used for new deciduous tree plantings.

Seeding and topsoil installation will also adhere to MASS. Most, if not all seeding in the project will be Schedule A. Other seed mixes will be selected from MASS as appropriate.

Hardscape elements such as fencing, landscape boulders and planters within the landscape that will be affected by construction will reviewed on a case by case basis. Property owners will be consulted and informed about the intended design solution along their properties. There will be an emphasis on communication and understanding with property owners while working with them to ensure that elements in their landscape affected by construction are appropriately addressed.

O. Right-of-Way Acquisition and Impacts

A key element for the successful completion of this project is the acquisition of any required easements and/or permits while providing fair and equitable treatment to all affected property owners, tenants and lessees.

The Municipality of Anchorage has the authority to acquire private property for public projects. A primary goal of ROW acquisition is to acquire property rights from willing sellers through good-faith negotiations in accordance with all pertinent policies, statutes, laws and regulations while treating all owners equitably. Property owners are entitled to receive just compensation for any property rights acquired. When owners are unwilling (or perhaps unable) to sell and property rights acquisition is demonstrated to be necessary for public projects, the MOA has the authority to acquire property through its right of eminent domain (ED). Condemnation is the process of exercising the right of ED and is prescribed by MOA code and state law.

The MOA's process for residential and business acquisitions follows the guidelines addressed in the State of Alaska's *Acquiring Real Property for Federal and Federal-Aid Programs and Projects* brochure, the *Relocation Services for Residential Property* brochure, and the *Relocation Services for Businesses, Farms & Non-Profit Organizations* brochure. 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. Storm drain easements (DE) are required for drainage facilities installed on 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 private 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 do not mutually benefit the property owner and the MOA.

Property owners who have personal improvements in the ROW, such as fences, retaining walls or landscaping boulders, have the option of applying for encroachment permits for the improvements, removing them at their own expense, or allowing the corrective action be incorporated into the project design.

Preliminary estimated easement/permit requirements are summarized in TABLE 13 below and are detailed in APPENDIX I. As the design of this project progresses, the required construction permits or easements, will be refined.

Table 13 - Estimated Right-of-Way Easements / Permits

Public Use Easement (PUE)	Slope Easements (SE)	Temporary Construction Easements (TCE)	Drainage Easements (DE)	Temporary Construction Permits (TCP)
2	0	2	6	204

8. Utility Impacts

When roadway and drainage improvements are made in urban areas, impacts to utilities need to be analyzed. Existing utility facilities are shown in APPENDIX D. For safety, underground minimum burial depths must be maintained.

In the ROW, the Municipality requires a minimum burial depth of 42-inches for gas lines, electric cables, telephone cables, fiber optic 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 or impacts from storm drain improvements over existing facilities will require relocation of said facility. In some locations the structural section excavation will impact utilities. In these locations it is assumed that the utilities will require relocation.

AWWU requires a minimum depth of cover of 10 feet over their water mains and 8 feet over their sewer mains. There are some locations along Image Drive and Reflection Drive that do not currently meet these requirements. The proposed roadway cross section includes 2-inches of rigid board insulation and will mitigate some reduction in cover above water and sewer mains. AWWU may elect to require additional insulation installed above the water main/sewer main to mitigate potential freezing or may require the infrastructure to be lowered. As previously stated, the preferred lift station location will require removing and relocating a fire hydrant, approximately 95 feet of water main and reconnecting three existing water services. The water main will be relocated within Reflection Drive west of the existing sewer main and proposed storm drain main.

ENSTAR's existing underground gas mains and services will be impacted by construction of the proposed roadway typical section and storm drain. The underground gas main crosses under Image Drive in 14 locations, Reflection Drive in 13 locations, and 6 other locations across the project area. Due to the depth of the structural section, these crossings will need to be lowered. There are over 100 crossings with proposed footing drain services and the existing underground gas main. Typically the proposed storm drain lines will be installed deeper than the existing storm drain lines which should allow the proposed footing drain services to be installed below the existing gas main. However, since the elevation of the gas main is unknown, for estimating purposes it's assumed that 30 proposed footing drain service crossings will conflict with the existing gas main and will require gas main relocation at those locations. The gas main elevations should be verified during the design to confirm conflicts.

ACS's underground telephone lines will be impacted where they cross under roads in the project area due to the depth of the typical section. This includes 4 telephone crossing on Image Drive and 4 crossings on Reflection Drive. Similar to ACS, CEA's and GCI's facilities will be impacted at roadway crossings. For GCI, this includes 19 crossings in the project area involving underground coaxial and fiber optic cable. CEA's underground single phase electric lines cross roadways in the project area 9 times and will need to be lowered to allow for construction of the typical section.

The utility relocation cost estimates for the project are shown in APPENDIX J.

9. Permitting & Agency Approvals

Because the project roadways are classified as secondary (local) urban residential roadways, it is not necessary to obtain approval of the DSR from the MOA Planning and Zoning Commission or the MOA Urban Design Commission. It is not anticipated that the wetlands located east of Image Drive will be impacted with this project but it is anticipated that work will be required in Reflection Lake Creek in order to re-install the culverts for the proposed storm drain and roadway improvements. Anticipated permits and agency approvals required prior to construction include:

- MOA WMS Storm Water Plan Approval
- USACE Wetlands Permit (likely a Nationwide Permit 3, 12, or 43)
- ADF&G Fish Habitat
- MOA Flood Hazard Permit
- DNR Temporary Water Use Permit for stream bypass operations and dewatering
- ADEC Approval to Construct Storm Drain & Water Improvements
- ADEC Construction General Permit (acquired by Contractor for stormwater discharges from construction activities)

Additional permits may be required as the design develops.

10. Construction Schedule & Phasing

Construction funding has not been received yet for this project, but it's anticipated that construction funds will be requested through MOA roadway bonds in the coming years. Construction could begin at the earliest in 2019 pending funding approval.

It is likely that funding amounts will be phased over multiple years which will necessitate that construction also be phased. Phased construction will also alleviate neighborhood impacts by only impacting a portion of the neighborhood at a time. See the construction phasing FIGURE 11 in SECTION 13 for potential construction phasing limits. Construction phasing limits will be refined as the design progresses.

11. Quantity and Cost Estimates

A summary of estimated project costs for the proposed improvements is presented below. Detailed construction and utility cost estimates can be found in APPENDIX J.

Table 14 - Summary of Estimated Project Costs

Category	Cost
Design & Management Total (estimated)	$2,338,000
ROW Acquisition Total	$110,000
Utility Relocation (10% Contingency) Total	$661,000
A. Design, ROW Acquisition, Utility Relocation	***$3,109,000***
Construction Roadway Improvements	$4,288,000
Drainage Improvements	$3,363,000
Illumination Improvements	$493,000
Water Improvements	$159,000
Construction Subtotal	*$8,303,000*
Construction Contingency (15%)	$1,246,000
Construction Management / Inspection / Testing	$681,000
B. Total Estimated Construction Cost (rounded)	***$10,230,000***
C. Overhead / Grant Accounting	***$2,354,000***
Total Estimated Project Cost (A + B + C)	***$15,693,000***

12. Public Involvement/Agency Coordination

The public involvement/agency coordination for the Image Drive / Reflection Drive Area Road Reconstruction project followed the MOA Context Sensitive Solutions (CSS) process as a general guide for best practices. In the initial project planning stage, the project team developed a list of key stakeholders including local residents, the University Area Community Council, agency and elected representatives of the project area. These key stakeholders were included in all public involvement events and announcements throughout the project.

A. Summary of Events

The public involvement and agency coordination for this project consisted of a mixture of both web-based and traditional paper documents, an open house style public meeting, and in-person presentation during a Community Council meeting and agency scoping meetings. TABLE 15 shows each major public involvement and agency coordination effort for the duration of the project. Items associated with each activity are included in APPENDIX K.

Table 15 - Public Involvement Events Schedule of Events

Date	Activity	Comments
February 2016 - Present	Website Development & Maintenance	Updated at key milestones. Residents can sign up to receive Constant Contact e-mails.
March 2016	Mailing List Development	Approximately 230 mailing addresses.
March 9, 2016	Constant Contact E-Mail #1	Announced project, how to get involved, surveying and geotechnical investigation work commencing.
March 10, 2016	Mailer/Door Hanger #1	Announced project, how to get involved, surveying and geotechnical investigation work commencing.
May 26, 2016	Questionnaire Mailer	Project related questions for residents.
May 27, 2016	Constant Contact E-Mail #2	Questionnaire posted on website to complete on-line.
August 1, 2016	Constant Contact E-Mail #3	Announced questionnaire results are posted on website for residents to view.
August 31, 2016	Constant Contact E-Mail #4	Announced additional geotechnical investigation work commencing.
October 18, 2016	MOA Traffic/Maintenance Mtg	Discussed proposed preliminary roadway design elements.
November 26, 2016	Open House #1 Mailer #2	Announced Open House #1.
November 28, 2016	Constant Contact E-Mail #5	Announced Open House #1.
December 7, 2016	University Area Community Council	Project introduction and announced Open House #1.
December 8, 2016	Open House #1	Presented draft improvements.
December 14, 2016	Constant Contact E-Mail #6	Thank you for attending Open House #1.
May 6, 2017	Utility and Department Notifications	Project notifications and map.
September 6, 2017	MOA WMS Mtg	Discussed proposed drainage & lift station concepts.
September 7, 2017	MOA St Maintenance Mtg	Discussed proposed drainage & lift station concepts.

November 6, 2017	MOA Flood Plain Administrator Mtg	Discussed proposed improvements in the flood plain

B. Project Website

The project website has been provided for ease of project information sharing. Website content includes a project overview, recent project news, project documents, link to provide comments/questions to the project team and project team contact information.

C. Project Area Mailing List

A mailing boundary that included approximately 220 area property owners and residents was developed, see APPENDIX K for project area mailing list map.

D. University Area Community Council

A representative from the project team attended the December 2016 University Area Community Council meeting. The purpose of attending was to update the community on the project and to announce the open house. While in attendance, the project team representative provided project information postcards and a sign-up sheet for future project updates by e-mail.

E. Questionnaire

A survey questionnaire was mailed and e-mailed out to the property owners/residents in May of 2016. The questionnaire was also available to be completed on-line by selecting a link on the project website. The purpose of the questionnaire was to solicit owners/residents feedback on various questions that would help the design team understand the issues in the project area. A total of 50 responses were received, of which 49 where homeowners. Roadway/drainage related responses to the questions are summarized below in TABLE 16, see APPENDIX A at the end of the Final Tech Memo for a complete summary of all questionnaire responses.

Table 16 - Roadway/Drainage Questionnaire Responses

Question	Answers
Have you ever experienced groundwater problems in your crawl space or basement?	No (35) Yes (15)
Do you have a foundation drain or sump pump?	No (36) Yes (12)
Are you aware of any drainage problems in the project area that need to be corrected?	Yes (25) No (22)
Do you have concerns about speeding in your neighborhood?	Yes (34) No (16)
Do you think additional space in the roadway is required for on-street parking?	No (36) Yes (13)
The existing sidewalks will likely be removed and replaced in their current locations. Do you feel there is a need to construct additional sidewalks in the neighborhood?	No (38) Yes (11)

F. Open House Events

A public meeting was held in an informal open house setting at MOA Planning & Development Center (4700 Elmore Road) on December 8, 2016. The open house had 9 attendees sign-in.

In addition to written comments, comments heard during the open house were recorded by making notes on the project open house plots. Each comment is listed in the summary found in APPENDIX K. Comments have been edited to remove personal information.

G. Stakeholder Coordination Meetings

The project team met with MOA Traffic, Street Maintenance, Watershed Management & the MOA Flood Plain Administrator to discuss and coordinate preliminary design concepts. A summary of each meeting is included in APPENDIX K.

H. Summary of Public Comments Received

All project comments that were received from the questionnaire, open house and from resident phone calls can be found in APPENDIX A and APPENDIX K.

13. Design Recommendations Summary

In order to achieve the project goals, the recommended project improvements include the following:

- Roadway Cross Section: The roadway cross-section for Image Drive, Reflection Drive and Defiance Street includes two 11-foot lanes, one 7-foot parking lane (33 feet total width back of curb to back of curb), and one attached 5-foot sidewalk. The project plans to remove and replace sidewalks in existing locations only except for two additional new locations: a new sidewalk is proposed on the north side of Image Drive from Reflection Drive to Mirage Circle (north) and on the east side of Image Drive from Reflection Drive to Ridgelake Circle.
- For the cul-de-sacs at the neck, the roadway cross-section includes two 10-foot lanes, one 7-foot parking lane (31 feet total width back of curb to back of curb) and 5-foot sidewalks will only be installed on Ridgelake Circle. The cul-de-sac bulbs will typically match the existing radii except for at Ridgelake Circle where the proposed back of curb will be narrowed by 1 foot in order to install the proposed 5-foot sidewalk. No lane striping is proposed on any of the roadways. Due to the existing dense layout of the driveways in the project area, Type 2 rolled curb is proposed. Where feasible, Type 1 barrier curb will be installed where there is an absence of driveways. Typical roadway cross sections for Image Drive/Reflection Drive are shown in

  FIGURE 9 and the project cul-de-sacs are shown in FIGURE 10. The proposed locations of the 5-foot sidewalks are shown in plan view in FIGURE 11.
- Roadway Horizontal and Vertical Alignment: The project roadways will typically follow the center of the right-of-way. The proposed preferred profile for Image Drive and Reflection Drive will force high/low spots by raising the grades to a minimum of 0.65%.
- Posted Speed Limit: It is proposed that the posted speed limit for Image Drive and Reflection Drive remain at 25 mph.
- Traffic Calming: The existing 4 speed humps along Reflection Drive and Image Drive are recommended to be re-installed as part of this project, see FIGURE 11 for location of proposed speed humps.
- Drainage: The proposed drainage improvements include replacing manholes, catch basins and storm drain pipe with CPEP perforated pipe (subdrain) throughout the project limits. Dual subdrains will only be installed where feasible. A below grade detention system will be installed within the dead end road of Mirage Circle (north). An oil and grit separator will be installed prior to the lift station for water quality. The existing sedimentation basin will be replaced with a detention basin and the outfall pipe from the basin replaced. Footing drain service stub-outs will be provided to all residents in the project area where a proposed storm drain is installed adjacent to the parcel. In order to construct the improvements, the existing Reflection Drive and Image Drive culverts will be removed and replaced with the same size culverts and stream substrate.

- Stormwater Lift Station: In order for the proposed subdrains to be located beneath the proposed structural section, the subdrain pipes will need to be installed lower than the existing Image Drive/Reflection Drive storm drain outfall elevations. Therefore, the installation of a stormwater lift station is recommended. The installation of a lift station will also alleviate the existing submerged storm drain outfall from the Image Drive storm drain system. The proposed lift station will be located at the northeast corner of Reflection Drive/Image Drive and will discharge into the proposed detention basin north of the lift station.
- Heat Trace: Heat trace will be re-installed within the existing Reflection Lake Creek culverts and at the inlet/outlet of the culverts. New heat trace will also be installed at the force main outfall, along the detention basin and in the pipe that outfalls from the detention basin to the existing storm drain system.
- Lighting: A continuous roadway LED lighting system, current with MOA standards is proposed.
- Landscaping: The proposed landscaping will be minimal; the focus will be on preserving existing vegetation to the greatest extent practical, supplementing the existing landscaping with new plantings when appropriate.

The MOA may choose to phase the construction of this project in order to coincide with funding requests and to minimize impacts to the entire neighborhood. See FIGURE 11 for potential construction phasing limits.

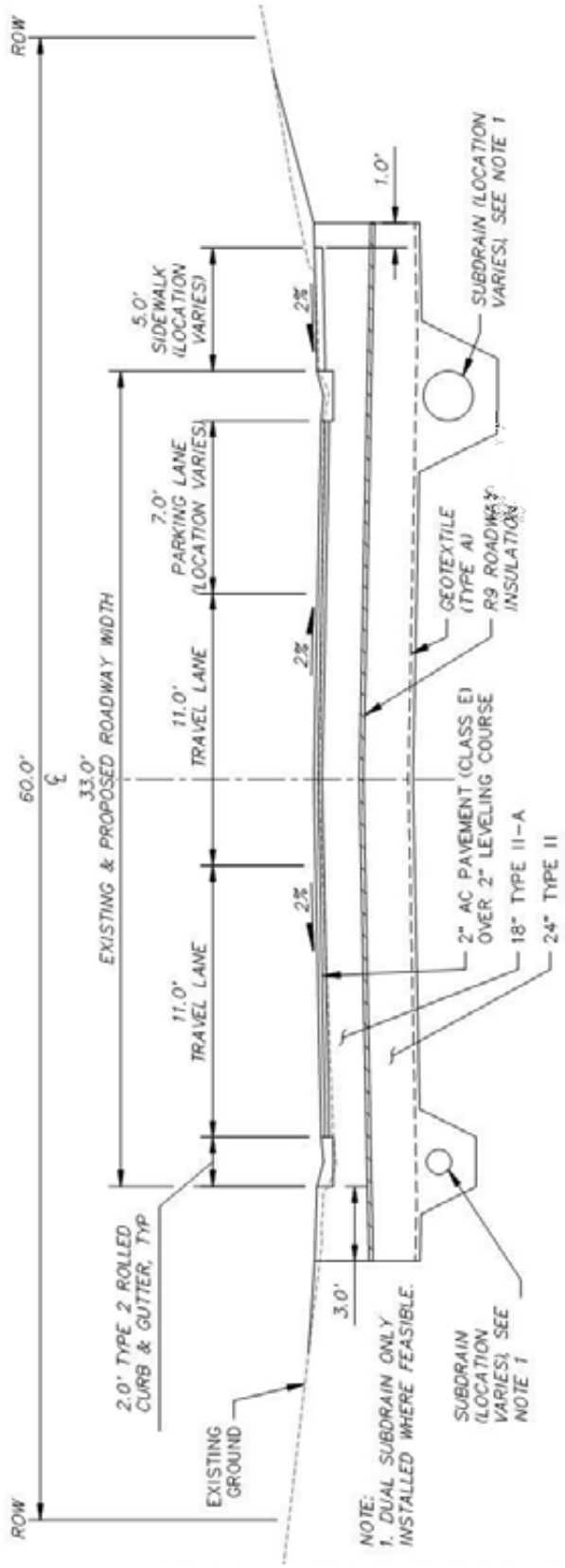


Figure 9 - Recommended Section for Reflection Drive and Image Drive

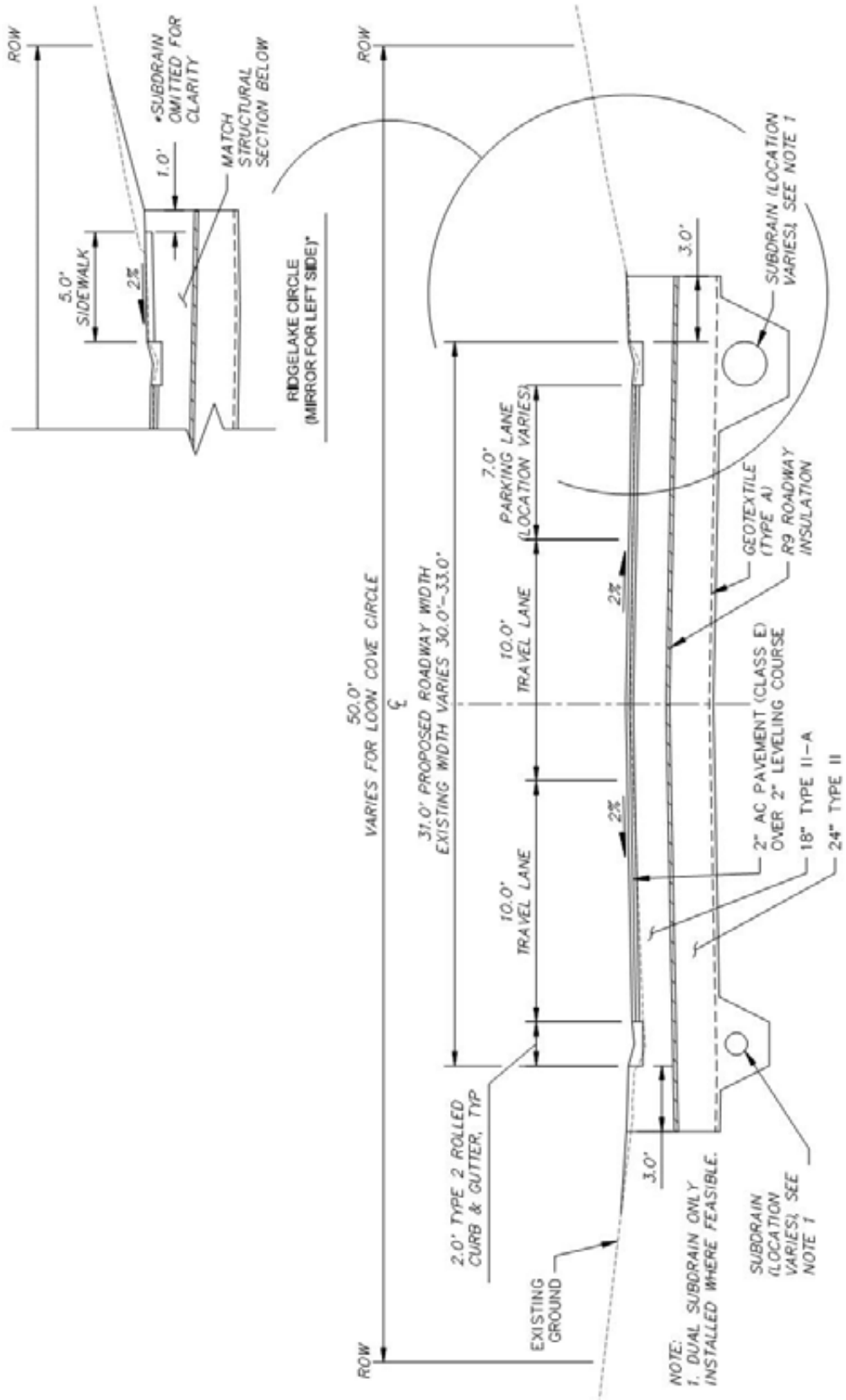


Figure 10 - Recommended Section for Cul-De-Sacs

Figure 11 - Proposed Sidewalks, Speed Humps & Construction Phasing

14. Proposed Variances from MOA Design Criteria Manual

The proposed variances from the MOA DCM for this project will be justified and approved under a separate document during the design process. There are several design criteria that may not be able to meet the MOA DCM. TABLE 17 lists proposed variances from the requirements in the DCM. This project may also require a number of driveway variances for landing lengths/grades, driveway grades and driveway distances to side streets. Additional variances may be required as the design progresses.

Table 17 - Summary of Draft Variances

	Criteria	Design Std. Value	Proposed Value[1]	Reference
Traffic Data	Posted Speed	30 MPH	25 MPH	DCM 1.5.E
Cross Section	Curb & Gutter	Type 2 (DCM) Type 1 (Title 21)	Type 2	DCM Figure 1-13 MOA Title 21.08.050.G
	Sidewalk Requirements	Both sides of roadway	One side of roadway	DCM Figure 1-13
	Sidewalk Separation from Back of Curb	7 ft	0 ft	DCM 4.2.H

1. Value only provided in proposed column if it differs from DCM standard value.

End Report

Technical Memorandum

Appendix A

Final Technical Memorandum

Date: November 30, 2016
To: Jennifer Noffke, Russ Oswald, PE (MOA PM&E)
Stephanie Mormilo, PE; Kris Langley, (MOA Traffic)
Paul VanLandingham (MOA Street Maintenance)
From: Justin Keene, PE; Erica Jensen, PE, PTOE (CRW Engineering Group, LLC)
Project: Image Drive/Reflection Drive Area Road Reconstruction
Project No: PM&E #14-50 (CRW#10133.00)
Subject: Final Technical Memorandum

A. Purpose and Background

The Municipality of Anchorage Project Management and Engineering (MOA PM&E) has contracted with CRW Engineering Group, LLC to provide professional services to evaluate alternatives to upgrade the Image Drive/Reflection Drive area (see FIGURE 1 for project boundary). The purpose of this Technical Memorandum is to gain concurrence from MOA PM&E, MOA Traffic Department, and MOA Street Maintenance Department on the roadway design elements before beginning the Design Study Report (DSR). A meeting was held on October 18th, 2016 with PM&E, Traffic, and Street Maintenance to discuss the roadway design elements; a draft of this Technical Memorandum was submitted to them on November 4, 2016 for their review and comment. Comments from their review have been incorporated into this Final Technical Memorandum.

B. Existing Conditions

A. Neighborhood Context, Traffic, and Zoning

The Image Drive and Reflection Drive area is a neighborhood of local roads situated north of Tudor Road and east of Boniface Parkway. The only access to the neighborhood is either from Reflection Drive at Boniface Parkway or from Defiance Street at Tudor Road. This "isolated neighborhood" condition is reflected in the existing annual average daily traffic (AADT) volume data (see TABLE 1). There are four speeds humps located in the neighborhood: two on Reflection Drive and two on Image Drive (see FIGURE 1). TABLE 2 summarizes the crash data from 2009 – 2014.

Table 1. Existing Conditions – Traffic Data

Roadway	AADT	85th Percentile speed (mph)	Year Data was taken
Image Drive	394	20	2014, 2016
Reflection Drive	450	23	2016

Table 2. Existing Conditions – Crash Data (2009-2014)

Date	Street	Nearest Cross Reference	Crash Type
1-13-2013	Reflection Drive	Image Drive (north)	Downhill runaway, unsafe speed
2-19-2011	Reflection Drive	Image Drive (south)	Parked vehicle, backing unsafely
1-15-2009	Defiance Street	Image Drive	Mailbox, unsafe speed

J:\Jobsdata\10133,00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\GIS\Existing Conditions_Sidewalks.mxd

Legend

- Project Boundary
- Existing 4' Sidewalk
- Existing Creek
- Existing Speed Hump
- Possible Sidewalk Location

CRW Engineering Group, LLC

Image Drive/Reflection Drive Area Road Reconstruction

Existing Conditions:
Traffic volumes, speed hump locations, and sidewalk locations

PROJECT:	10133,00
STATUS:	Conceptual Design
DATE	November 2016
SCALE	NTS
FIGURE	1

The neighborhood is zoned R-2M "mixed residential" and R-2A "two family residential (larger lot)" and consists of 195 single-family homes. Over half of those homes front the main roads of Reflection Drive and Image Drive: Reflection Drive has 75 driveways that access it while Image Drive has 48 driveways.

B. Roadways, Drainage, and Creek Crossings

The existing roadway grades in the project area are generally very flat, between 0.1% and 0.7%. Just beyond the project limits, there are steep hills to access the neighborhood; Reflection Drive near Boniface Parkway has existing grades up to 11.0% and Defiance Street has grades up to 8.8%. The existing conditions of the roadway pavement, concrete curb and gutter, and concrete sidewalks are generally poor with cracking, settling, ponding, and heaving.

Other existing roadway conditions are summarized in TABLE 3 below.

Table 3. Existing Conditions – Roadway

Item	Value	Notes
Right-of-Way (ROW) Width Main roads Culs-de-sac (at the neck)[1]	 60 ft. 50 ft.	Existing improvements are centered in the ROW
Roadway width[2] Main roads Culs-de-sac	 33 ft. See right	 33 ft.: Mirage Cir. (n), Image Cir., & Ridgelake Cir. 30 ft.: Mirage Cir. (s), Keyann Cir., & Loon Cove Cir.
Curb type	Type 2	rolled
Sidewalk width	4 ft.	See FIGURE 1 for location of existing sidewalks
Posted speed	25 mph	

1. Loon Cove Circle has a ROW that varies up to 70 feet
2. Roadway width is measure from back of curb to back of curb

There are currently two, separate piped storm drain systems for the neighborhood. Each system includes perforated pipe (subdrain) and non-perforated pipe segments. Each system outfalls to its own settling basin located at the north end of the project. Each settling basin then outfalls through a piped storm drain system that was installed in 2012 that discharges to the South Fork of Chester Creek.

Footing drain services are stubbed out to the majority of the parcels in the project area where a storm drain or subdrain line exists in the ROW. It is unclear how many parcels are actually connected to the footing drain services.

The neighborhood is located within the Upper Chester Creek sub-watershed and Reflection Lake Drainage Basin. An unnamed creek extends from Reflection Lake, directly south of the neighborhood, and meanders northwards along the back of some parcels before flowing into one of the settling basins as discussed above. The unnamed creek crosses the project area roadways at two locations: Reflection Drive near the south side of the project and Image Drive at the north side. Both of these crossings were upgraded in 2012 with a 36-inch diameter culvert and a 24-inch overflow culvert at each crossing. Heat trace was installed in each of the creek culvert crossings.

C. Utilities

The neighborhood is served by public water and sewer. The project area also includes existing "shallow" utilities and associated appurtenances such as electric, cable television, natural gas, and telephone/communication lines, junction boxes, pedestals, etc. Further information regarding the existing water and sewer systems and shallow utilities, and any impacts to these systems, will be analyzed and discussed in the DSR.

D. Illumination

The project area currently has existing roadway illumination. It is anticipated that the roadway illumination will be removed and replaced to meet current MOA lighting standards. A full illumination analysis and design recommendations will be provided in the DSR.

E. Survey Questionnaire

A survey questionnaire was mailed and e-mailed out to the neighborhood in June of 2016. A total of 50 responses were received, of which 49 where homeowners (see APPENDIX A for survey responses). Relevant roadway/drainage related responses to the questions are summarized in TABLE 4.

Table 4. Questionnaire Responses

Question	Answers
Have you ever experienced groundwater problems in your crawl space or basement?	No (35) Yes (15)
Do you have a foundation drain or sump pump?	No (36) Yes (12)
Are you aware of any drainage problems in the project area that need to be corrected?	Yes (25) No(22)
Do you have concerns about speeding in your neighborhood?	Yes (34) No (16)
Do you think additional space in the roadway is required for on-street parking?	No (36) Yes (13)
The existing sidewalks will likely be removed and replaced in their current locations. Do you feel there is a need to construct additional sidewalks in the neighborhood?	No (38) Yes (11)

C. Design Challenges

Some of the significant design challenges associated with the Image Drive/Reflection Drive project area include:

- There are 195 homes in the project area with driveways located closely together, limiting the space to construct Type 1 barrier curb.
- The closely spaced driveways also limit available snow storage; MOA Street Maintenance has expressed that the existing space used for snow storage should not be reduced.
- Many residents perceive the grassed right-of-way (ROW) area in front of their house as part of "their front yard." Expanding the hardscape improvements, such as sidewalks, may cause resistance from the public for "taking their perceived yard."

- Residents expressed concerns about speeding, although traffic data gathered over two years did not support this concern. It is unknown if removing the existing speed humps would raise speeds in the project area.
- Street grades are typically flat, as low as 0.1% percent. There are known drainage issues in the project area.
- Reflection Lake is located at the southern edge of the project limits and an unnamed creek runs through the project area, limiting drainage options due to high ground water and the existing creek elevation at the project outfall locations.

D. Design Criteria & Proposed Design

A. Roadway Alignment and Typical Cross Section

The MOA Design Criteria Manual (DCM) requires roadway improvements to be centered in the ROW; the existing roadway improvements are centered in the ROW. It is anticipated that the proposed roadway centerline alignment will also be centered in the ROW, but during the DSR and design phase, it will be investigated if shifting the roadway to either direction can help minimize impacts to existing development.

The design criteria values from the DCM and Anchorage Municipal Code (AMC) Title 21 for a local roadway typical section, as well as the proposed value for this project, are summarized in Table 5.

Table 5. Roadway Design Values

Design item	Design Value	Proposed value	Design value from
AADT	416	N/A	Traffic study
Roadway Classification	Secondary Street: Urban Residential	-	DCM Section 1.3 C
Street width[1]			
Main street	33 ft.	33 ft.	DCM Table 1-6
Low volume cul-de-sac[2]	31 ft.	31 ft.	DCM Table 1-6
Driving lanes	2 – 11 ft. lanes	2 – 11 ft. lanes	DCM Table 1-6
Parking lanes	1 – 7 ft. lane	1 – 7 ft. lane[3]	DCM Table 1-6
Curb type	Type 1 (barrier)	Type 2 (rolled)[4]	DCM Figure 1-13
Design speed	25 mph	25 mph	DCM Table 1-6
Posted speed	30 mph	25 mph	DCM Section 1.5 E
Sidewalk location	Required both sides	Remove and replace in existing locations only[5]	DCM Figure 1-13, AMC Title 21
Sidewalk width	5 ft.	5 ft.	DCM Figure 1-13

1. Street width is measured from back of curb to back of curb.
2. Mirage Circle (north) would be demolished; also see discussion below.
3. The parking lane would not be striped; no roadway centerline/ shoulder/parking lane lines are proposed.
4. Where topography behind the back of curb and absence of driveways allows, Type 1 (barrier) is proposed.
5. See FIGURE 1 for locations of existing 4-foot wide sidewalks; also see discussion below.

Mirage Circle, north of Image Drive, is a dead-end roadway. A connection to the property to the north is not anticipated. Thus, it is proposed demolish the existing pavement, curb & gutter, and

sidewalk at Mirage Circle (north), replace with topsoil/seeding, and construct curb and gutter continuously along Image Drive. If a lift station is installed as part of this project, this may be a suitable location for the lift station and maintenance access.

In addition to reconstructing sidewalks at their current locations, the DSR will investigate adding new sidewalks at two locations (also see FIGURE 1):

- East side of Image Drive, south of Ridgelake Circle
- North side of Image Drive, west of Mirage Circle (north)

B. Roadway Profile

The proposed vertical profile geometry will generally follow the existing terrain but forced high and low spots will likely be added to increase the roadway grades to provide adequate drainage. The forced high and low spots will improve drainage but be located to minimize impacts to existing development. The vertical profile will be further analyzed and refined in the DSR and design phases.

E. Proposed Traffic Calming

Based on the neighborhood survey questionnaire, residents expressed concern with speeding in their neighborhood. However, two traffic studies conducted two years apart indicate the 85th-percentile speed is below 25 mph on both Image Drive and Reflection Drive.

Currently there are four speed humps in the project area and it is unknown what the 85th-percentile speeds were *before* installation of the speed humps. The Traffic Calming Manual published by MOA in 2005 states that before installation of speed humps will be considered, one of the following criteria must be met:

- 500 vehicles per day average daily traffic and 85th-percentile speed greater than 25 mph *or*
- Less than 500 vehicles per day and 85th-percentile speed greater than or equal to 30 mph

Currently, neither of these criteria is met – the AADT is less than 500 and the 85th-percentile speed is below 25 mph, although the impact of the existing speeds humps on the 85th-percentile speed is unknown. Based on a comment received from the survey questionnaire, a resident of the neighborhood advocated for installation of these speed humps.

Since the Traffic Manual was published in 2005, additional studies and concerns have been raised regarding speed humps. Speed humps exacerbate drainage issues during the spring break-up when ice and snow block the narrowed drainage route between the speed hump and the curb, blocking the stormwater flow path. Additionally, speed humps delay the response of emergency vehicles including fire trucks, police vehicles, and ambulances.

Since it is often difficult to remove existing traffic calming measures without receiving negative feedback from residents, the DSR will investigate appropriate traffic calming for the project neighborhood. Non-vertical measures, such as long-tapered chokers and on-street parking, as well as speed humps will be reviewed and analyzed in the DSR. The analysis will include the effectiveness of a traffic calming measure, such as a neck-down, constructed with rolled curb as well as the location of a neck down in relation to the numerous driveways.

F. Proposed Storm Drainage

A full storm drain analysis, including the need for sub drains and/or footing drains, will be included in the DSR. It is anticipated that a lift station may be required due to the high ground water and existing

creek elevation at the project outfall locations in relation to the proposed structural section as recommended in the draft geotechnical report.

G. Recommended Design – Typical Section

Based on the design challenges listed above, it is recommended to minimize impacts to adjacent properties and development. The recommended typical section for Image Drive and Reflection Drive is:

- 33 feet back-of-curb to back-of-curb (2 – 11-foot lanes + 1 – 7-foot non-striped parking lane).
- Type 2 curb and gutter (rolled); where topography behind the curb and absence of driveways allows, Type 1 curb and gutter (barrier) would be installed.
- The existing 4-foot wide sidewalks would be removed and replaced with 5-foot wide sidewalks in their existing locations only. Additional 5-foot wide sidewalks will be investigated at the following locations:
    - East side of Image Drive, south of Ridgelake Circle
    - North side of Image Drive, west of Mirage Circle (north)
- All curb ramps would be updated to meet current Americans with Disabilities Act (ADA) requirements.

Based on the neighborhood survey response, it is anticipated that adding a sidewalk on both sides of the roadway throughout the project area will not be favored by the community. Additionally, the cost of construction will increase by more than just the cost of labor and material for constructing a concrete sidewalk. The impacts to adjacent developed properties could require retaining walls, re-grading the full driveway, additional easements, or other potentially costly measures to avoid impacting houses. Unless additional funding is anticipated to become available for construction, it is recommended to only reconstruct sidewalks in their current locations (except as noted above). The recommended typical section includes a 5-foot wide sidewalk on one side only (see FIGURE 2).

Although this typical section does not meet DCM requirements for curb type or number and location of sidewalks, it does improve the existing conditions of the project area and progresses the roadway closer to ADA requirements and DCM compliance.

H. Design Variance

Design variance will be required from MOA Traffic for those items which do not adhere to the DCM. Design variances are anticipated for:

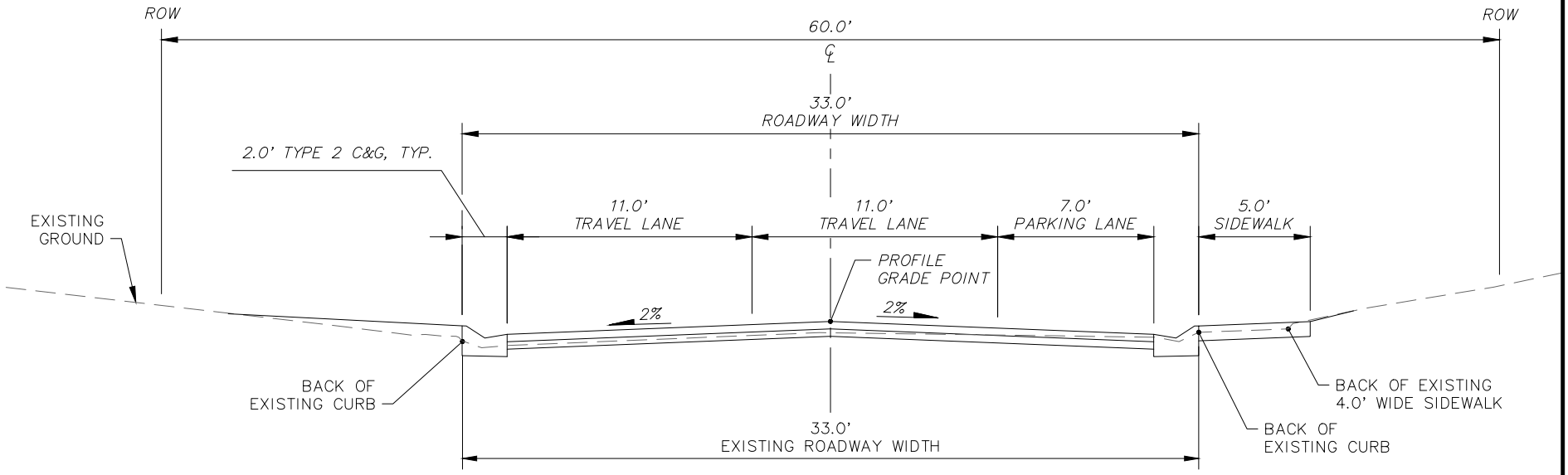
- Curb type: Type 2 curb and gutter is proposed (DCM requires Type 1)
- Sidewalk location: sidewalks are proposed mostly along only one side of the roadway (DCM Figure 1-13 requires sidewalks along both sides)
- Posted speed: the posted speed is proposed at 25 mph (DCM Section 1.5 E requires 30 mph)

I. Cost Estimate

A cost estimate will be prepared for the DSR.

J. Summary and Next Steps

Based upon support from MOA PM&E, Traffic and Street Maintenance the Draft Design Study Report will be prepared based upon the approved typical section as shown in Table 5 and FIGURE 2.



CRW ENGINEERING GROUP, LLC
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#AECL882-AK

CONCEPT

MUNICIPALITY OF ANCHORAGE

IMAGE DRIVE/ REFLECTION DRIVE
AREA ROAD RECONSTRUCTION
PM&E #14-50

PROPOSED TYPICAL SECTION

Project No:	10133.00
Drawn By:	ESJ
Scale:	NTS
Date:	NOV 2016
Figure:	2

FILE NAME: J:\Jobsdata\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\Image_Recommended Section.dwg

Appendix A
Questionnaire Responses

PM&E Project # 14-50

Questionnaire (June 2016)

IMAGE DRIVE / REFLECTION DRIVE AREA ROAD RECONSTRUCTION

The Municipality of Anchorage (MOA) Project Management & Engineering (PM&E) Department is planning to upgrade the Image/Reflection Drive area (see map on right). Improvements are expected to include new road foundation, asphalt pavement, storm drain system, pedestrian facilities, and street lighting.

The project is funded through the draft Design Study Report (DSR) phase. No funding for construction has been received at this time.

Please take a moment to fill out this questionnaire and return it to CRW Engineering Group, LLC (CRW) by June 15, 2016. You can mail it in (just fold it, insert it in the included envelope and drop it in the mail), fax it to 561-2273, or e-mail your comments to comments@crweng.com. You can also fill out the questionnaire on-line by visiting the project website: www.imagereflectiondrive.com, or provide comments over the phone by calling Justin Keene at CRW, the Design Manager, at 562-3252.

Your comments are important to us. We will use this information to aid in designing the improvements.

Name:

Physical Address:

Mailing Address (if different):

E-Mail (optional):

Phone (optional):

Questionnaire Responses are below in blue.

1. Can we send you future project updates via e-mail?	**36** Yes **13** No
2. Do you own the property?	**49** Yes **1** No
3. Have you ever experienced groundwater problems in your crawl space or basement?	**15** Yes **35** No

- *Occasional problems, compounded by new development above my property.*
- *One sump pump, it didn't do the job. So I have to put the second one in the crawl space.*
- *Almost every year at break-up or fall rainy weather. Saturated ground; sometimes standing water. Second pump eliminates standing water.*
- *Water in crawl space when it rains for days and break up flooding.*

QUESTIONNAIRE RESPONSES

- *We have only had the smallest amount of water when it has been raining for 15-20 days straight or there is a massive melting. All of it can be removed with a wet vac.*
- *Recently purchased house - unaware of issues*
- *Drain down the street clogged forcing water in the crawl space.*
- *Groundwater in our crawl space. We had to put a sump pump in. during heavy rains, and when the water table raises are the only times we had water.*
- *Drains in roadway were frozen*
- *During storms of August/September 2012 the street flooded due to the nearby creek and due to clumps of leaves blocking drains, the corner our house is on is the low point of the neighborhood. We had no direct flood but did have ground water seepage into our crawl space of a few inches during one of the worst flood events, it dissipated quickly however and no damage was detected.*
- *Spring time before I installed sump pump.*
- *But we don't look often.*
- *During years where there is snowfall in Anchorage when the snow melts. During large scale rain events.*
- *Water during break-up.*
- *The walls of my crawl get wet. The weatherization company changed the wet insulation 2 years ago.*
- *Before we moved in, our crawl space was wet. Have a sump pump now. But I would not be surprised if future flooding issues arise because of the large amount of water that pools in front of our house due to drainage issues.*
- *Some seepage due to lack of gutters on back of house.*

4. Do you have a foundation drain or sump pump?	**12** Yes **36** No
If yes, how many? **Where are they located?** **Where does it drain?** **How often does the pump run? (i.e. all year, spring, fall, after storms, etc.)**	

- *1, Crawl space, to french drain under lawn on side of house, 1 time per year*
- *2 sump pumps, Crawl space, to the sink in the garage, Spring, fall, when lots of snow and rain.*
- *2 sump pumps, Crawl space, Side yard, Spring and fall rains*
- *One, Back left of house - corner (south), Side of house, Rarely - never water*
- *1, Crawl space, Unknown, Spring (all year)*
- *1 sump pump, Crawl space SE corner, Sewer line, Spring and after storms*
- *1 foundation drain, Around foundation, Away from foundation*
- *Street city drain*
- *1 sump pump, Crawl space, Drains to the front yard SE side of the house, After storms*
- *1, Crawl space, Storm Drain, Once in a while*
- *1 foundation drain, into the street*

QUESTIONNAIRE RESPONSES

- *One, In crawlspace, Manually operated after explained events.*
- *One automatically runs in the crawl space under the house and it runs in the spring/meltdown and empties in the back yard.*
- *As far as I know one, I'm guessing in the crawl space or side of house, Never seen it drain, I'm not sure, Does not pump much water out. I don't hear it that often anyway.*

5. Is your driveway heated or constructed with concrete?	**1** Yes	**48** No
6. Is there any special condition on your property that you feel the design team should be aware of in designing the project?	**14** Yes	**34** No

- *Restore paving stones, side walk easement on bank/ in lawn.*
- *two pipes coming up in my driveway*
- *Drains stick up in the driveway*
- *E 40th lacks a drain… Floods down to Loon Cove property.*
- *The road bed sunk about 2" so did the sidewalk and 10' of my driveways now sidewalk+driveway are broken up, I get a pool of water in front of driveway when it rains. Water does not get to storm drain.*
- *Watermain in driveway needs to be fixed. The shut off valve broke. The driveway is not level.*
- **Does buried treasure count*? :)*
- *Pipes under driveway. in the winter time the driveway raises 1" in center from frost heave. Can you help?*
- *Garden along property line and fences.*
- *We, like a lot of our neighbors, do have a fence on the lot line next to the street. We'd hate to have it damaged or be forced to take it down of course though since I doubt this work includes a street expansion I don't see why that would be needed.*
- *Pipe sticking out of driveway, Also driveway is settling*
- *No changes to be made*
- *All our property slopes slightly toward the fence line and on the right for draining away from the house*
- *We just had the driveway paved 2 years ago.*
- *Underground sprinkler system that needs to be protected. New asphalt driveway that needs to be protected, and prefer not to be demolished beyond the back of curb & gutter.*
- *Retaining wall and Landscape*
- *Wavy streets, weed grass growing on sidewalks, cracked streets & sidewalks, uneven streets or wavy - feels like there are speed bumps every 10 ft when you're driving*

7. Are you aware of any drainage problems within the project area that need to be corrected?	**25** Yes	**22** No

- *Road drainage is generally very poor.*
- *Garage drain doesn't drain properly.*

- *My yard on the left side (looking at the house from the street) is unusually wet in the spring and when it rains*
- *Neighbors house sump to the south of me and constantly runs and dumps to yard.*
- *Flooding where Reflection meets Image Drive (out towards Boniface.)*
- *The Loon Cove draining improvement project. Call Van Le from RIM consultants for a project update.*
- *When culvert project opened the road we found that storm drain line in the center of Reflection Dr. was rotted out. Reflection Dr. has frost heaves like driving off-road!*
- *There is a dip in front of our driveway that collects water.*
- *The water backs up between 3969 and in the backyard.*
- *Reflection Dr.*
- *New Little Bear St. does not have any drains. When the rain runs down Reflection down the hill it pools up badly. Why are there no drains here?*
- *Drain across the street at 3668 is draining very slow during break up.*
- *Green belt and lake used to flood, but since they have heated coils in the stream, seems to be working but we have had mild winters (3 years.)*
- *There is a depression in the road just between my neighbor and I which allows water to sit.*
- *On Reflection by intersection of image it doesn't drain well when it rains or when it's break up season (melting snow/ice.)*
- *during breakup we experience large puddles*
- *Not enough storm drains - many puddles stick around for days.*
- *The creek floods periodically causing massive amounts of water to flow down our street.*
- *The culvert regularly overflows*
- *On Reflection the lake drains under the street from the lake.*
- *Water pools at various locations within the neighborhood.*
- *Floods where small creek flows under Image Dr. in NE corner of neighborhood.*
- *Defiance left. Jordan Circle and McLean floods with heavy rain and melting snow.*
- *From the easement area behind the properties on the west side of Reflection.*
- *Already corrected.*
- *Right in front of my house and our next door neighbor - really bad drainage, water pools badly. I'm sure other houses have the same issue.*
- *There is one area on Defiance that pools water.*
- *Dip in rain gutter.*

8. What are the top 3 things you would change about the streets within the project area?	

- *Access to Boniface is very poor for the traffic and pedestrians, Steep sidewalk on Reflection about 24% grade is unsafe*
- *Speed bumps, Widen the street*

QUESTIONNAIRE RESPONSES

- *Renew-smooth out.*
- *Leveling the streets "Roller Coaster" problems, Level and replace concrete sidewalk fractures/heaves.*
- *Drainage - make sure slopes correctly, Fix cracks, Fix sidewalks and driveway connected to the sidewalk - last foot.*
- *No changes needed*
- *Pot holes, Uneven roads, Everything about the sidewalks, Uneven roads, Everything about the sidewalks*
- *Better pavement of streets, Better sidewalks, Better drainage*
- *remove the ice heaves which have torn up the streets, work on the drainage issues from the lake*
- *Replace all broken side walks, Better Drainage, Speed bumps*
- *Side walks on both sides of the street, better formed curbs to help prevent snow plow build up on sidewalks, imroved drainage*
- *Add chokers and "chicanes" to slow traffic, Reduce corner radii, Allow parking only on one side of the street*
- *Speed humps to slow down traffic, Build side walks that people can't park on.*
- *Safety for vehicles coming down the hill*
- *sidewalks on Refelction Dr.*
- *Things you already plan to do - smooth them out, better lighting*
- *More street lights, Drainage problem on Defiance and Reflection Dr.*
- *Nothing - They fixed the creek drainage and that was all*
- *speed bumps, Electronic sign, sidewalk on both sides*
- *Re-seal road - get rid of bumps and holes, Get rid of speed bumps as they don't work.*
- *Roads need resurfaced, Better city maintenance*
- *regrading of reflection, redesign of Boniface to Reflection intersection(just outside of project area though)*
- *Drainage - Slope to drain, Surface quality*
- *Lighting, Smoother roads, Slower speed limits*
- *The frost heaves on the R, Water drainage off street by Reflection and image reflection corner before Loon Cove Circle, More speed humps/bumps to slow people down*
- *Eliminate the need for a U-turn heading on Boniface onto Reflection.*
- *The speed at which people drive around Reflection curve, More storm drains*
- *Its way too bumpy and rolls*
- *Extremely bumpy, Flooding culvurt*
- *Add speed bumps*
- *Better road surface*
- *Frost Heaves*
- *Repave to smooth out road, Fix drainage, Provide speed bumps*
- *Rough, rough, rough!*

- *Fix pot holes, Level out frost heaves*
- *Need more speed humps on main streets*
- *sidewalks on both sides of street, more speed humps, add additional safety features such as crosswalks*
- *create or maintain sidewalks, make sure street signs are visible and clear from foliage*
- *Slower traffic, More pedestrian areas, Better visibility at turns*
- *Fix drainage, Fix streets & sidewalks, Make streets wider, sidewalks narrower(need a sidewalk on both sides of the streets, houses across from us do not have a sidewalk) also need street lights in the winter*
- *Smooth it out (frost heaves are bad), Drainage and Add speed humps - people drive too fast (lots of kids in neighborhood)*
- *Better drainage. Smooth surface.*

9. Do you have any concerns about speeding in your neighborhood?	**34** Yes **16** No

- *People speed up and down Reflection Dr. hill, the hill is blind and sidewalk is too steep so people with strollers or elderly walk on roadway.*
- *Need a speed bump outside my driveway.*
- *Drivers come down the hill from Boniface too fast.*
- *Slight concern*
- *Cars - cut through and go fast.*
- *Many cars zoom past kids and zoom into Loon Cove*
- *Kids walking along the creek cross road to get to the lake. Drivers don't slow down.*
- *The speed bumps, as they currently are, don't deter people from speeding. There are cars that go to fast heading northbound on Image Drive in the winter and run into a resident's mail box repeatedly. A significant speed bump needs to be installs dot help prevent this from happening.*
- *Many vehicles speed. A very family oriented neighborhood.*
- *People drive too fast coming down Defiance St. The neighbor on my left has had vehicles hit and mail boxes smashed. My kids have almost been hit while crossing the street do to speed and no visibility as cars come down the curve/hill.*
- *During winter, vehicles regularly lose control going up and down hill and sometimes end up in my driveway - and have destroyed my mailbox multiple times.*
- *Tudor/defiance and curve of Reflection Dr.*
- *This is a huge problem! PLEASE keep the "speed humps." A friend spent two years convincing the municipality to install them. They do help and make a big difference.*
- *Way too fast, too many kids for current speed.*
- *Make the [speed bumps] higher and more of them to slow traffic.*
- *People do not pay heed to speed bumps or children in area.*
- *There needs to be more speed bumps.*

- *A small minority do drive faster than they should in the neighborhood but we already have several speed bumps and a very poor surface in some areas so I doubt those particular individuals will be discouraged by anything that wouldn't be a nuisance to everyone else. A speed bump on Image right after coming onto it from Reflection would likely be appreciated by the families with children who play in that area though.*
- *Not even speed bumps help*
- *I have seen a few cars at speeds of 35-40 mph. With so many cars parked on the street it is hard to see children and we are concerned about someone getting hit.*
- *We see lots of people speeding through the neighborhood. We can hear their back end of the vehicle scrap the speed hump as they sped though. There are lots of kids out playing in our neighborhood.*
- *Families with small children need to display signs in the road, continue using speed humps vs speed bumps.*
- *We live on the corner of Reflection (circled on reverse) and many people speed around the curve. There are many children in our neighborhood, this prevents them from playing safely.*
- *People speed coming around the curve on Defiance and often speed through the stop sign on Image Drive.*
- *25 mph is too fast*
- *Occasionally people drive through, but it is not too bad.*
- *Main streets have straight-aways that could use more speed humps.*
- *Speeding past our house.*
- *Vehicles speed currently, add more traffic calming*
- *People are not driving with caution, we had our mail box knocked down and our car hit three times. Please install speed bumps if possible.*
- *People aren't thinking about the possibility of children riding bikes out of their driveway.*
- *Yes, especially cars coming from Boniface & Reflection Dr (downhill). Entrance from Boniface to Reflection is too narrowed, harder to see if anyone is walking/biking/etc. It will be even bigger problem with more traffic coming from the new townhouses being built on "Little Bear"*
- *People drive too fast. When they come around our curve in road, they won't have time to stop if a kid is in the road since they can't see far enough around to slow down.*

10. Do you think additional space in the roadway is required for on-street parking?	**13** Yes **36** No

- *People use the sidewalk for parking.*
- *Widen the street.*
- *Unsure*
- *People park on the sidewalks forcing kids to bike and walk in the street :(*
- *There is enough space for on street parking. The main issue comes in with residents who insist on always parking in the streets and consider the streets an extension to their driveways.*
- *Don't like parking on street. The Snow plow ends up having to go around them, then we are left with snow berm in the road.*

- *On street parking should be reduced.*
- *Too many cars parked along the road and blocks visibility of kids playing/walking along the road. Kids have to go into the road do to cars parked on the sidewalk when walking/riding the bikes.*
- *Reflection Dr.*
- *I think the streets are already wide enough - seems to encourage speeders. People should be parking in their garage/driveways unless they have company.*
- *Road way too narrow.*
- *Any vehicles parked on roadway either block driveways or bottleneck traffic*
- *Many people park on the streets and there is obstruction.*
- *There are so many cars that park on both sides of the street which makes it hard to back out of the driveway especially if towing something. It also makes traffic back up due to only room for 1 way traffic.*
- *At times too many people park on the street only allowing one car to drive through.*
- *No room*
- *Please do not add additional space on roadway, people often park on both sides of the street for too long anyway.*
- *Absolutely not! Too many homeowners park on the streets but have plenty of space in their driveways that could be used. On-street parking should only be used for guests or friends, and not for continuous parking.*
- *Add more space for parking*
- *people often park in the center of the culdesac which is dangerous if emergency vehicles are unable to reach and I have never seen that in any neighborhood but ours and I do not know the legality of this*
- *Narrow roadway does not.*
- *Need a wider roadway for sure in general.*
- *There is plenty as is.*
- *Need road to be slightly wider.*

11. Are you aware of any sight distance problems (i.e. trees or structures blocking traffic view) that may need to be corrected as part of the project?	**11** Yes **39** No

- *Reflection Dr. hill with access to new high density property development.*
- *There are some trees around the fourth house too close to the sidewalk that blocks the when turning the corner.*
- *The turn at the end of reflection across the street from the circle (southend) is hard to see around especially if the car is parked on the corner - by Loon Cove circle.*
- *Hill/curve on Defiance (circled on map) when crossing street of turning into driveway. Cars coming from Tudor are going too fast and can not see through the Curve/Hill.*
- *One at the corner of Reflection and Image Drive.*
- *This may be out of the project area but the intersection of Boniface to Reflection is horrific, the dynamics of the road are poor including a blind beyond 90 degree right turn from high speeds if*

coming from Boniface and the site lines leaving via that intersection require a car to come straight into the pedestrian right of way blind in order to see incoming traffic (or pedestrians). A in-progress housing development right at the intersection is going to make problems worse.

- *Over grown trees going up hill to Boniface on the right.*
- *Reflection Drive at Providence Drive even though it is outside the project limits*
- *At my home address my neighbor has a tree that blocks my view when exiting my driveway. If it is ok with them, its removal would be great. We are on a curve which makes it more dangerous.*
- *See Boniface & Reflection Dr entrance - big concrete fence seem to block the view when turning - need a mirror there and wider roadway*

12. The existing sidewalks will likely be removed and replaced in their current locations. Do you feel there is a need to construct additional sidewalks in the neighborhood?	**11** Yes **38** No

- *Reflection Dr. hill should have re-graded sidewalk.*
- *Would be nice on both sides*
- *Loon Cove, both sides of the street*
- *There are sufficient sidewalks to walk on them completely around the neighborhood. I do this almost daily with my dog.*
- *On image circle and reflection drive*
- *Just add curbs to keep people from parking on them, fix angle at location 1 on map, too steep.*
- *I like the way they are*
- *Reflection Dr. and Defiance*
- *I have three kids and they play just fine on the sidewalks now.*
- *On North side*
- *Areas that may be candidates for expansion would take away from home owners' property.*
- *Yes, there is a need but will impact residents perceived front yards*
- *Mirage Circle*
- *Otherside of street.*
- *Both sides should have a sidewalk - just make it narrower. Make the roadway/streets wider instead.*

13. Please include any other comments.	

- *Pedestrian access to Boniface should remain open during construction phase. Increase "sow" to include Reflection Dr. hill.*
- *We are concerned about the amount of shaking and vibrating of our house during construction.*
- *More signage about kids playing and bus stopping - school*
- *Thank You!*
- *I am extremely concerned about this project cutting off my access to my garage. Every time I have parked my car on the street it has been broken into or damaged. There is a major problem*

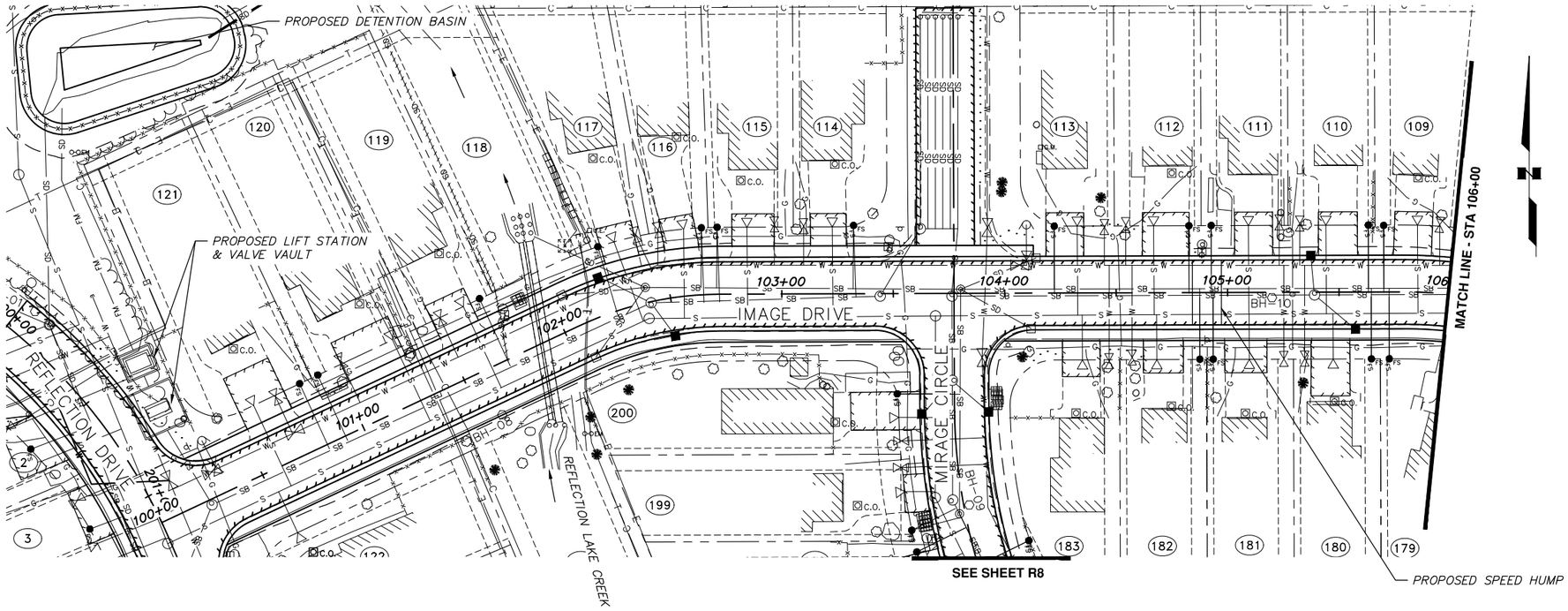
with property crimes to vehicles in our neighborhood. I am not willing to park my car on the street while this project is completed. Access to the homes needs to be maintained throughout the process or a guarded fenced lot needs to be set up for residents.

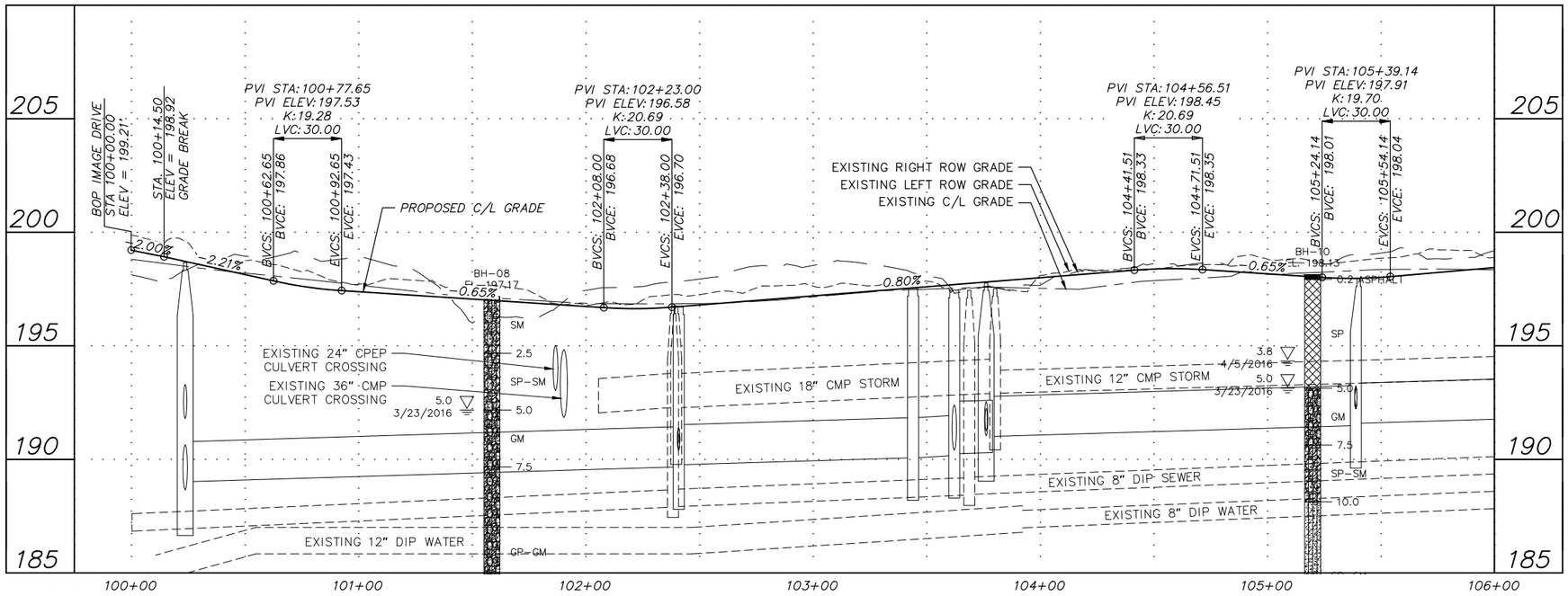
- *Broken sidewalks not repaired when culverts were installed, only small section even though new asphalt went beyond sunkun, broken curb+gutter.*
- *I hope this happens soon.*
- *The neighborhood needs speed humps added. The sidewalk at location 1 is too steep, people building condos made it steeper so now it is unusable in the winter. Also kids on bikes build up too much speed going down the hill.*
- *The project manager is awesome! In fact, I taught him french in high school!*
- *Can you help on my driveway? "Put in 9 driveway since 1984 last about 2 year."*
- *Find a way to have people maintain their property so it does not bring down the value of the neighbors. Make plans for eyesore trailer park behind project area. Set standards.*
- *More speed bumps!!*
- *Our neighborhood had terrible drainage problems up until a project in the last several years to fix it. I would not say it's a current issue that needs to be looked into but I do think it needs to be considered as part of the project to ensure the prior solution is working and that any new work doesn't disrupt those solutions.*
- *Thank you for taking the time to get review of our feedback.*
- *None.*
- *I have noticed that the work that was done last year is already sinking and uneven in areas, what ever is done needs to be done correctly. The creek is being obstructed by trees that soil during strong windstorms. Need to be removed.*
- *Say hi to Jon H. and Tracy M. for me.*
- *We have lived at this location for 20 + years and think other than frost heaves and pot holes the roads are excellent.*
- *Maintenance of the new pavement and sub-grade is an on-going thing, and should be monitored. Too much water intrusion into the base course results in premature failure.*
- *Creek levels rise with large rain events and spring melt when we have snow. Anyway that the project could help make it so the creek doesn't rise and back up water in crawl space would be great.*
- *Need all issues (top 3 at least) RESOLVED immediately please. Thank you.*

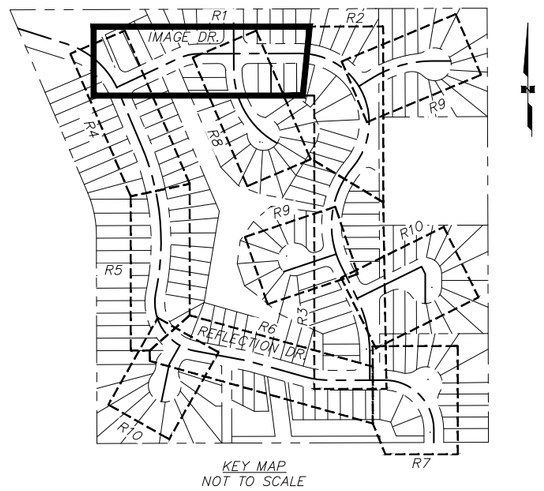
WE APPRECIATE YOUR INPUT

Roadway Plan & Profile Drawings

Appendix B







KEY MAP
NOT TO SCALE

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 60 30 0 30 60 SCALE

CONSTRUCTION RECORD

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

VERTICAL DATUM

REV	DATE	DESCRIPTION	BY

REVISIONS

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
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@ACLB82-AK

CONSULTANT

SEAL

MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

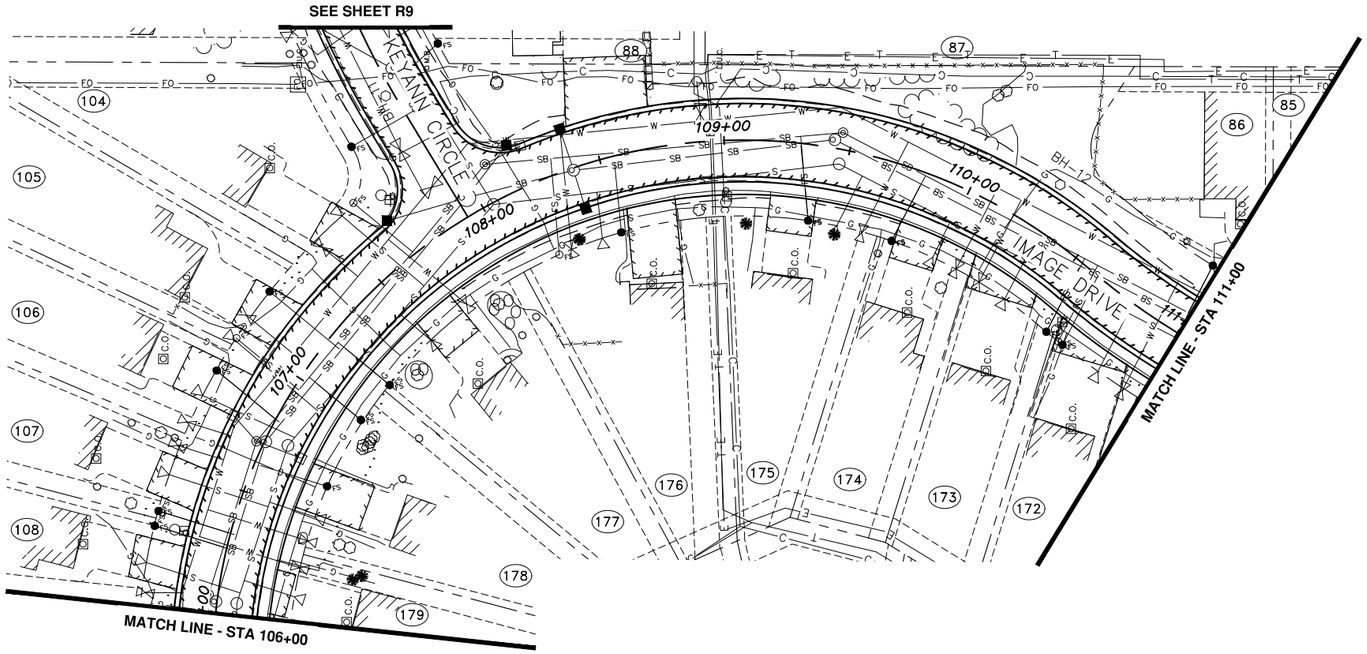
ROADWAY PLAN AND PROFILE

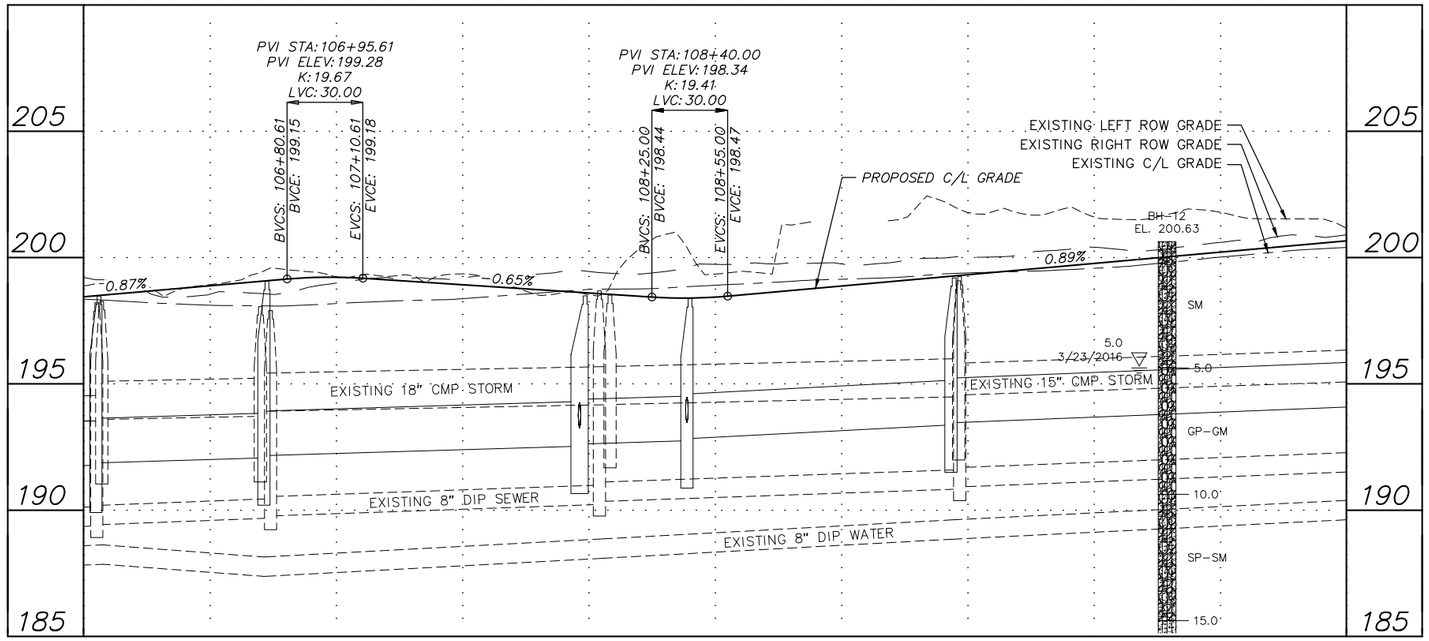
IMAGE DRIVE
STA 100+00 TO 106+00

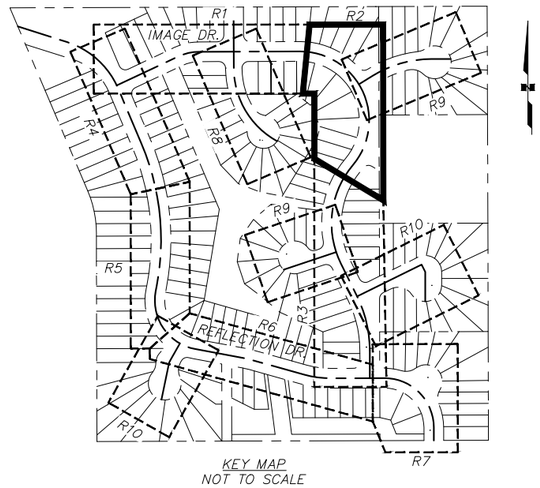
SCALE HOR. 1"=30'
VER. 1"=3'

GRID 1627, 1727
DATE DEC 2017
STATUS DSR
SHEET R1 of R10

File: J:\JobsData\Y0133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\Y0133.00 Plan And Profile - Roadway.dwg







KEY MAP
NOT TO SCALE

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 60 30 0 30 60

FIELD BOOKS	TBM 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

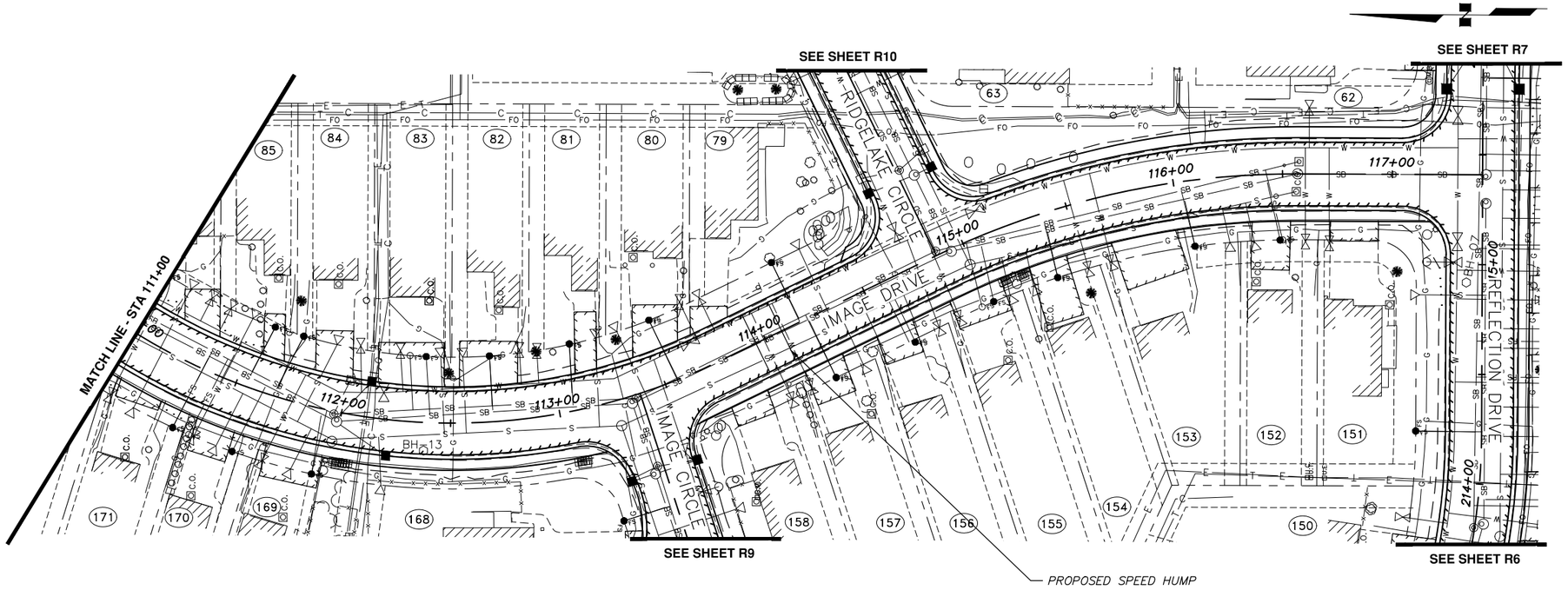
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

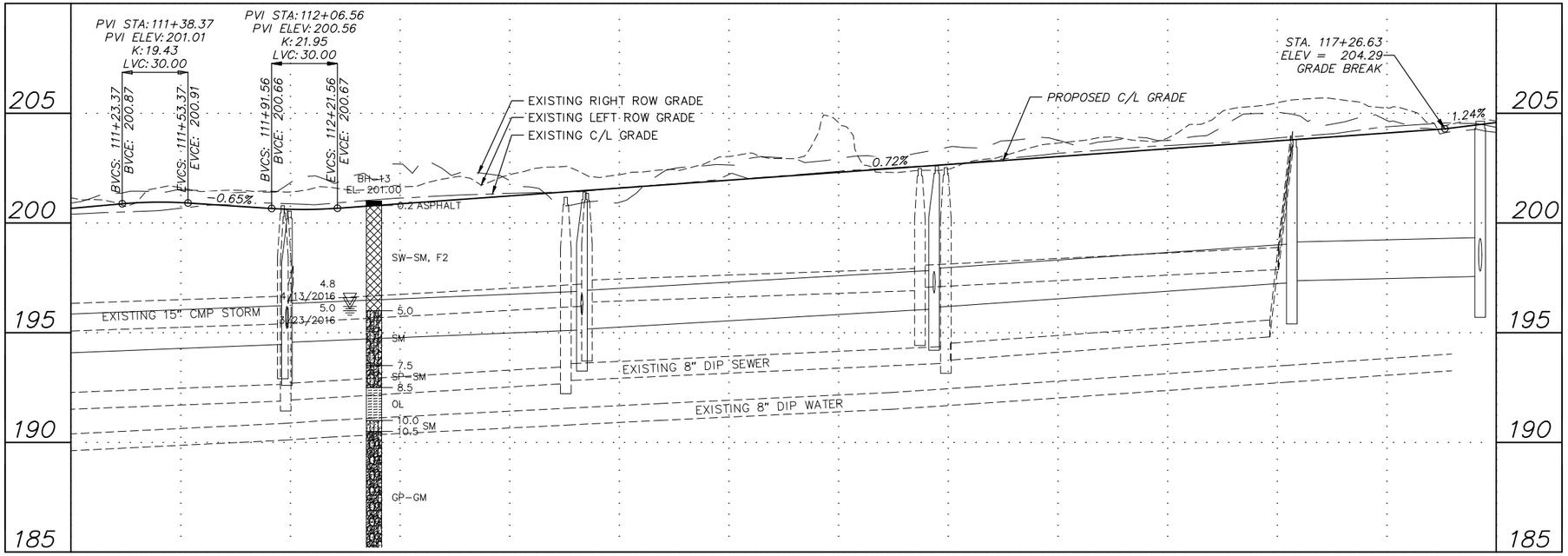
ROADWAY PLAN AND PROFILE

IMAGE DRIVE
STA 106+00 TO 111+00

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET R2 of R10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Roadway.dwg





KEY MAP
NOT TO SCALE

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 60 30 0 30 60

FIELD BOOKS	
DESIGN	
STAKING	
ASBUILT	
CONTRACTOR	
INSPECTOR	

CONSTRUCTION RECORD

TBM 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

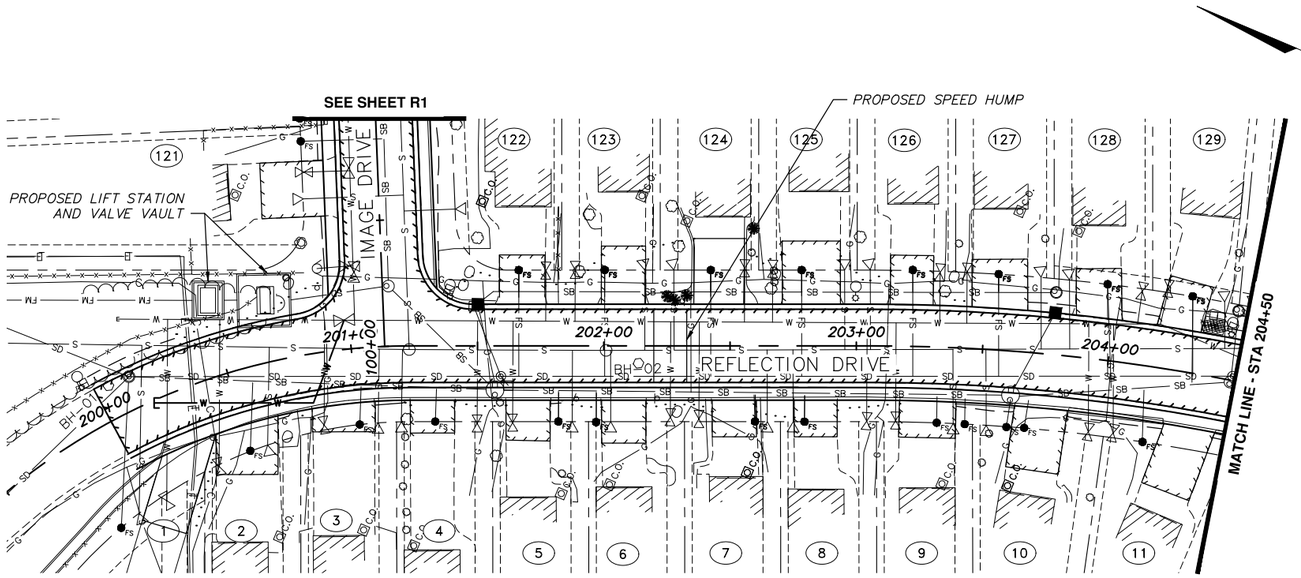
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

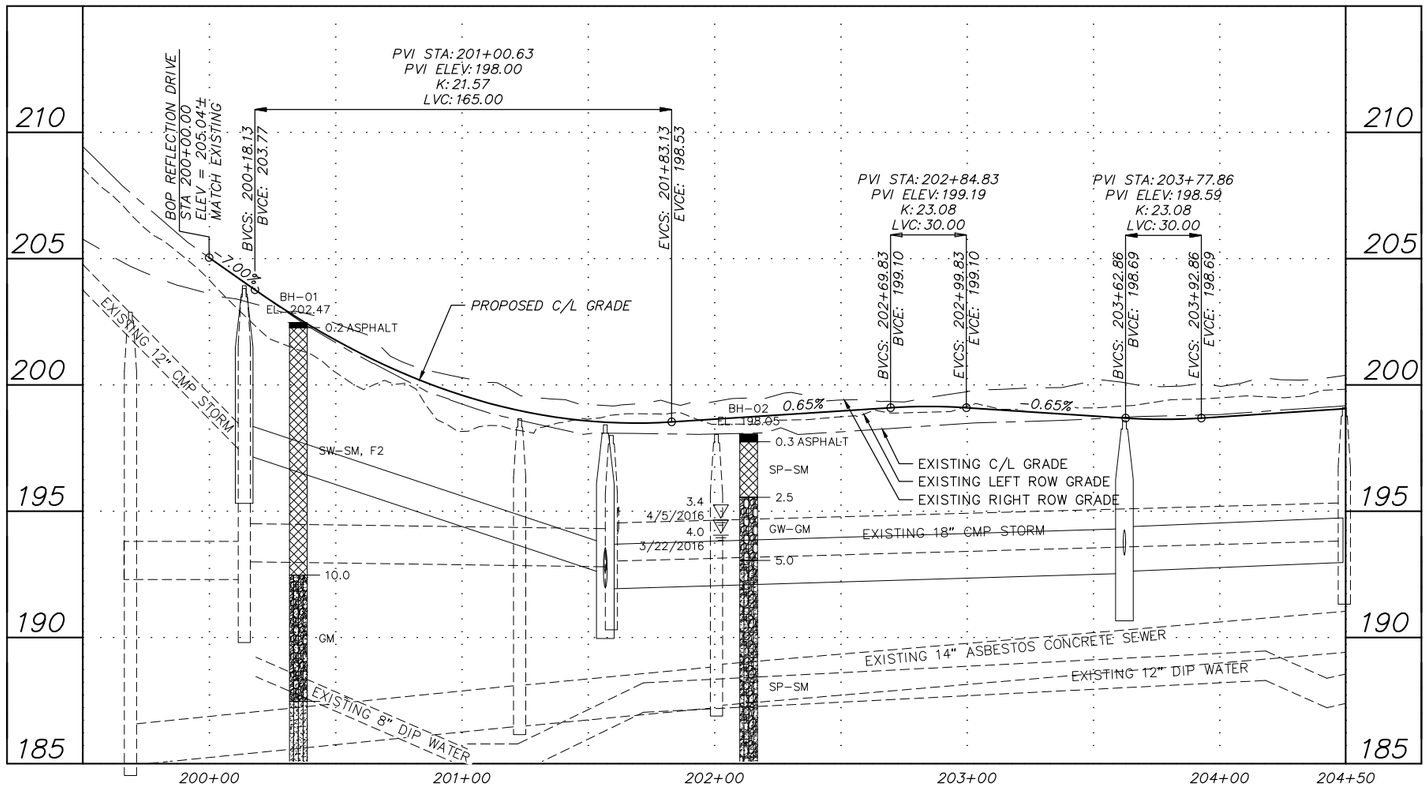
ROADWAY PLAN AND PROFILE

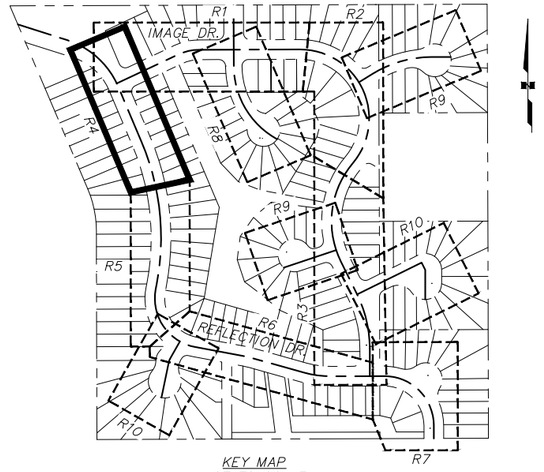
IMAGE DRIVE
STA 111+00 TO 117+41.13

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET R3 of R10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Roadway.dwg







KEY MAP
NOT TO SCALE

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 60 30 0 30 60

FIELD BOOKS	TBM 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
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CONSULTANT

SEAL

UNIVERSITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

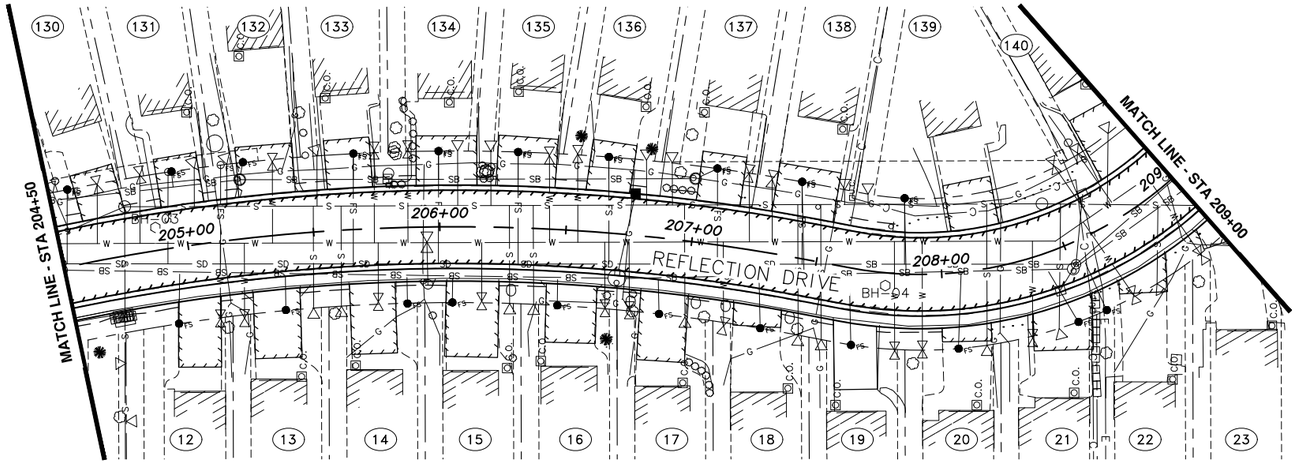
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

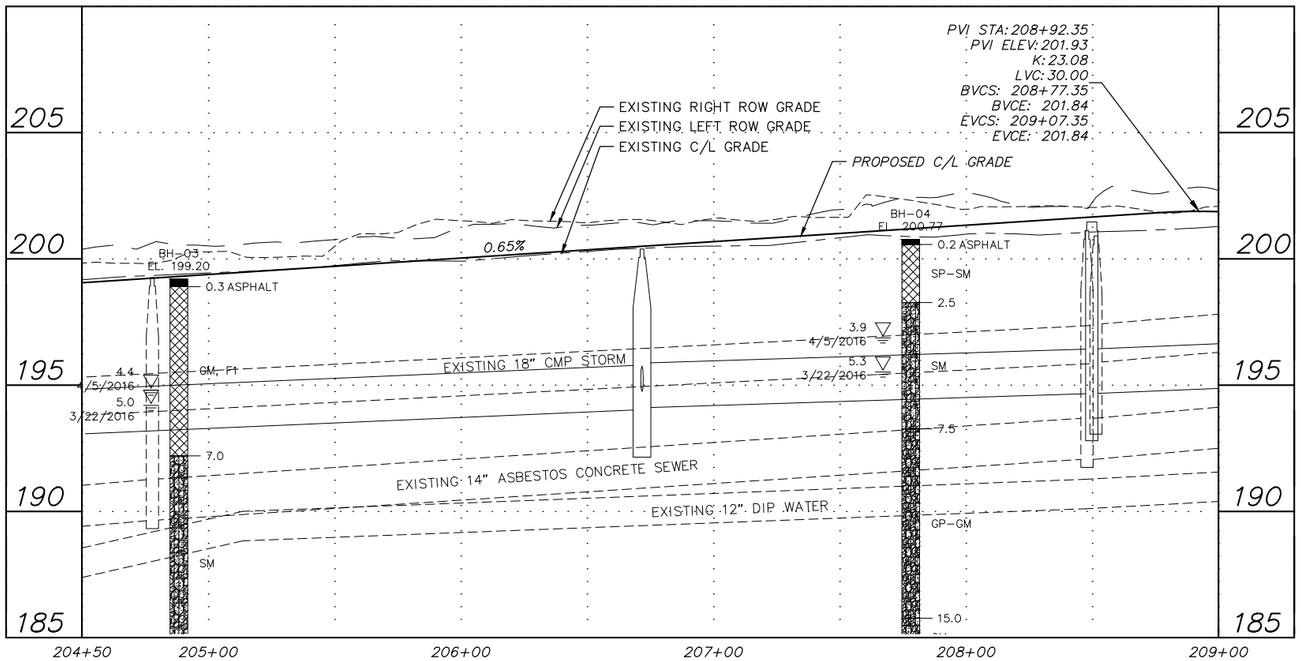
ROADWAY PLAN AND PROFILE

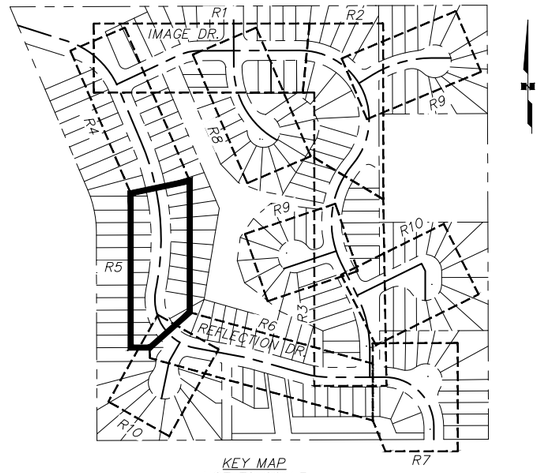
REFLECTION DRIVE
STA 200+00 TO 204+50

SCALE HOR. 1"=30'
VER. 1"=3'
GRID 1627, 1727
DATE DEC 2017
STATUS DSR
SHEET R4 of R10

File:J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Roadway.dwg







KEY MAP
NOT TO SCALE

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 60 30 0 30 60

FIELD BOOKS	TBM 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

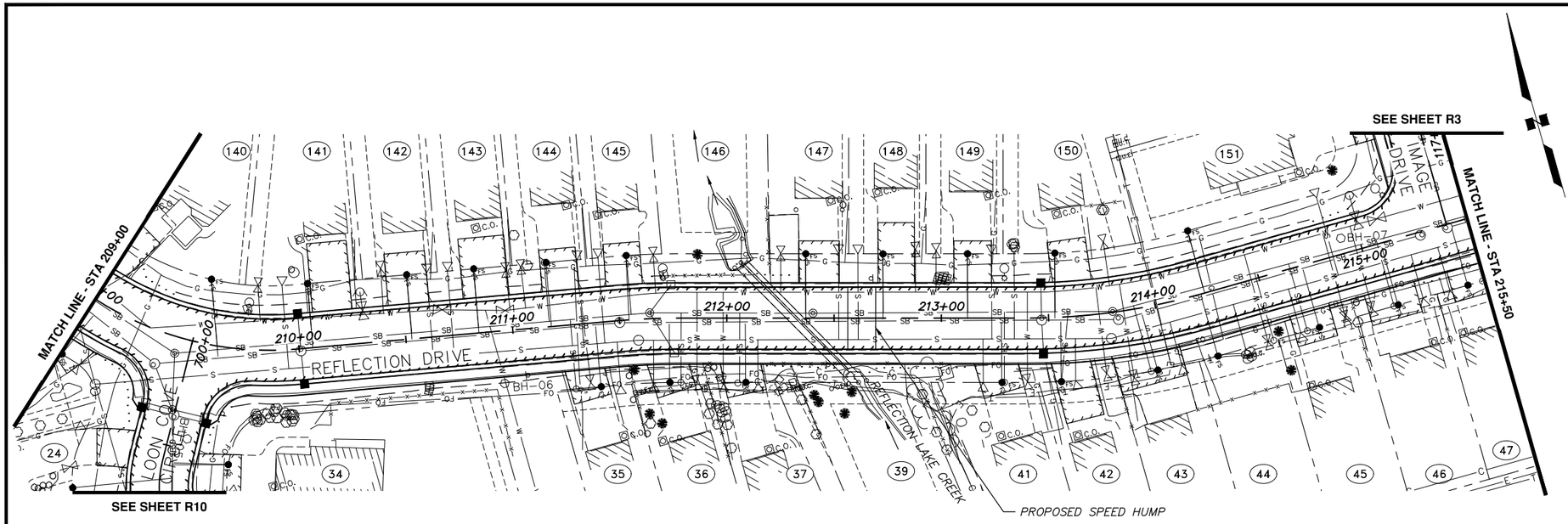
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

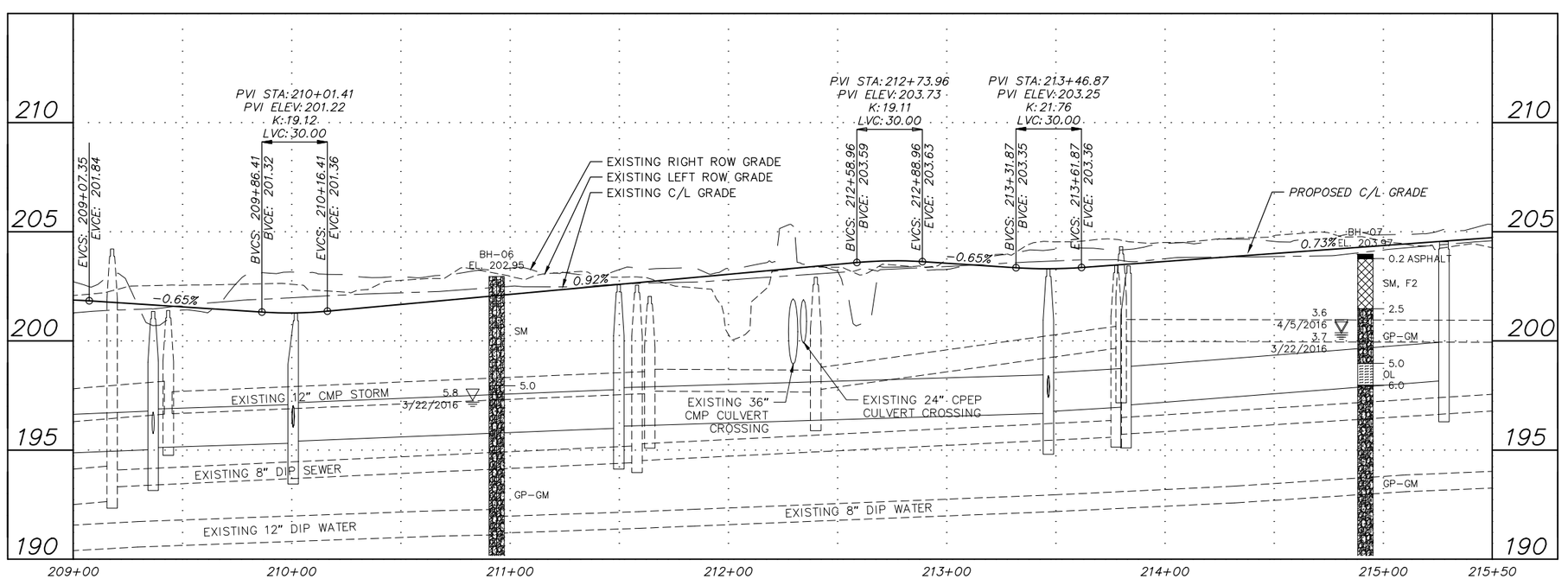
ROADWAY PLAN AND PROFILE

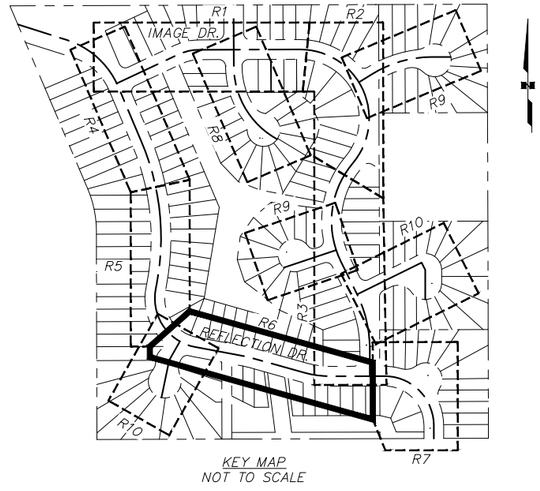
REFLECTION DRIVE
STA 204+50 TO 209+00

SCALE HOR. 1"=30' VER. 1"=3'
GRID 1627, 1727
DATE DEC 2017 STATUS DSR
SHEET R5 of R10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And 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 60 30 0 30 60 SCALE

FIELD BOOKS	TBM 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

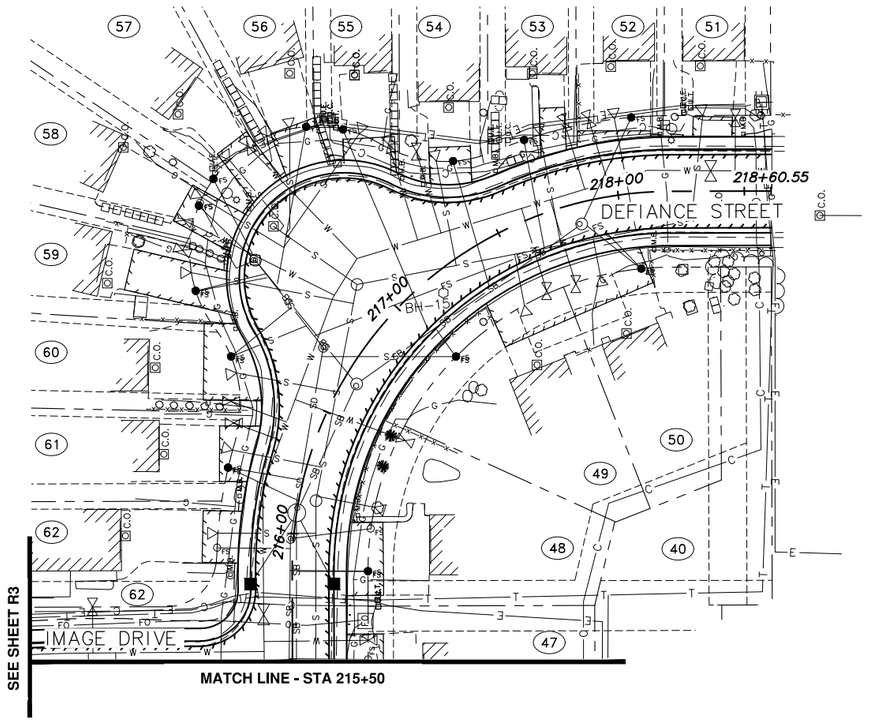
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

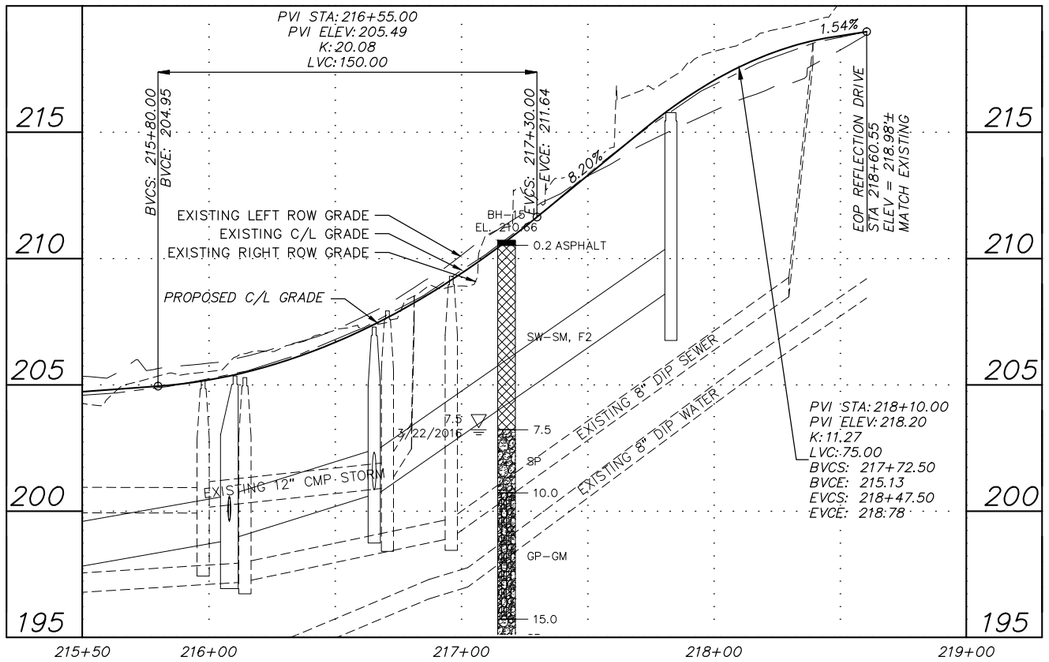
ROADWAY PLAN AND PROFILE

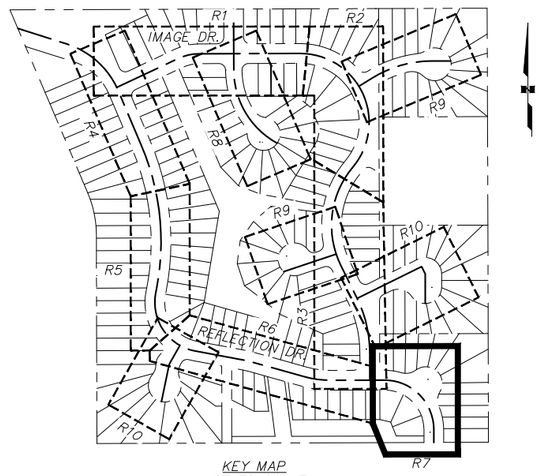
REFLECTION DRIVE
STA 209+00 TO 215+50

SCALE HOR. 1"=30'
VER. 1"=3'
GRID 1627, 1727
DATE DEC 2017
STATUS DSR
SHEET R6 of R10

File: J:\Jobs\Data\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile – Roadway.dwg







KEY MAP
NOT TO SCALE

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 60 30 0 30 60

FIELD BOOKS	TBM 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

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MUNICIPALITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

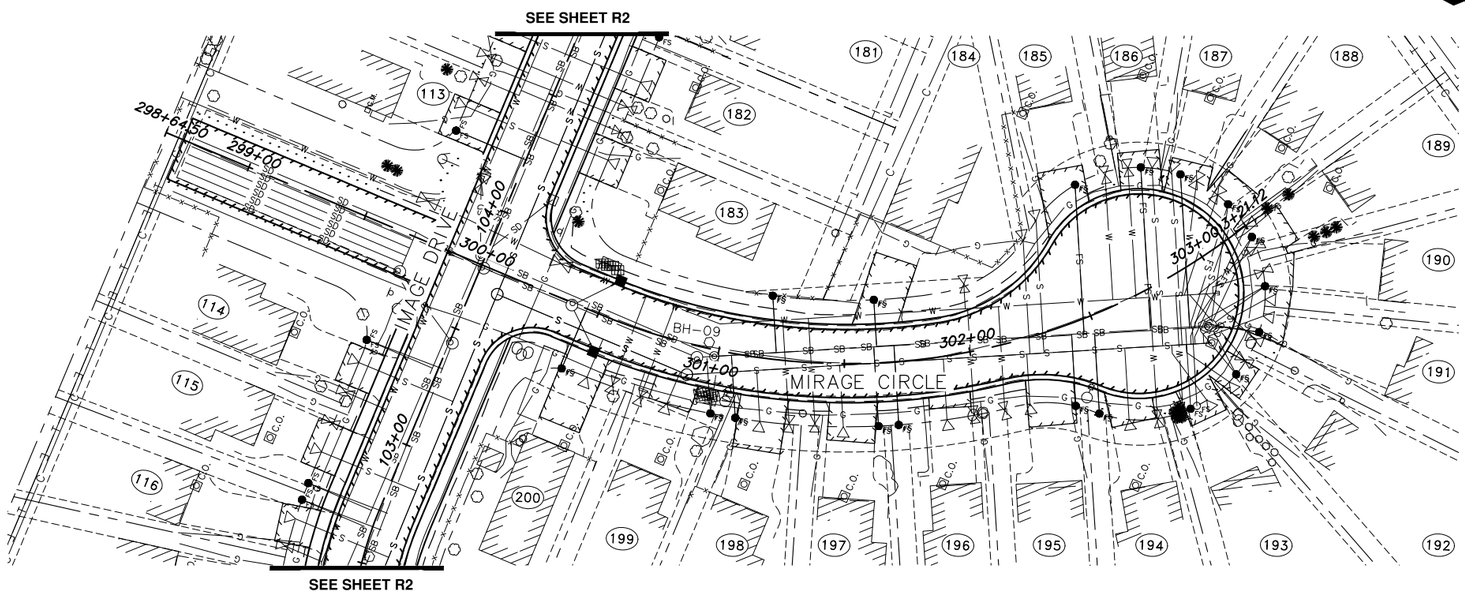
ROADWAY PLAN AND PROFILE

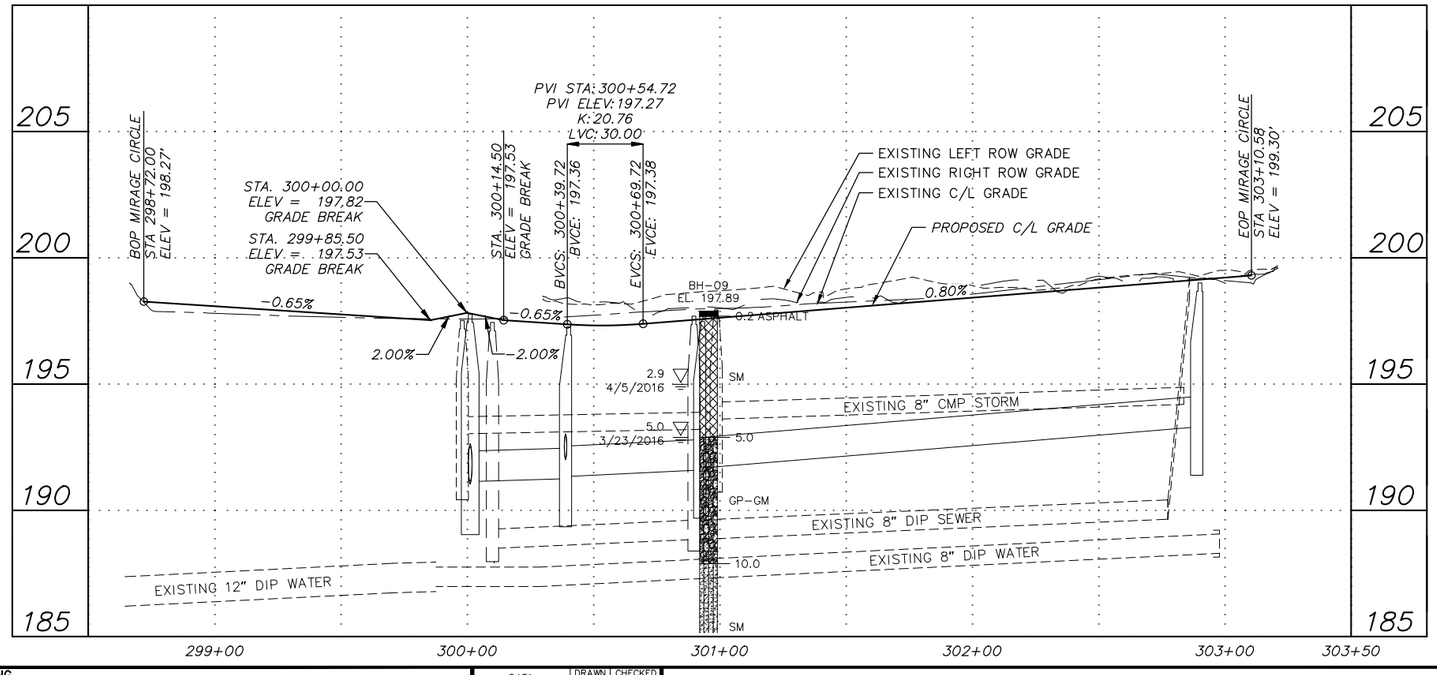
REFLECTION DRIVE
STA 215+50 TO 218+60.55

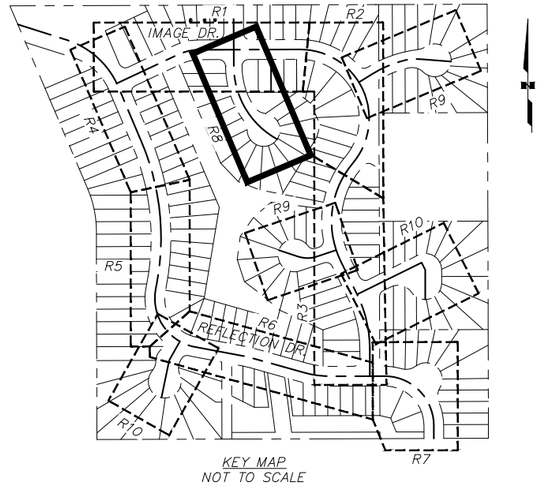
SCALE HOR. 1"=30'
VER. 1"=3'

GRID 1627, 1727
DATE DEC 2017 STATUS DSR
SHEET R7 of R10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And 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 60 30 0 30 60

FIELD BOOKS	TBM 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

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

ROADWAY PLAN AND PROFILE

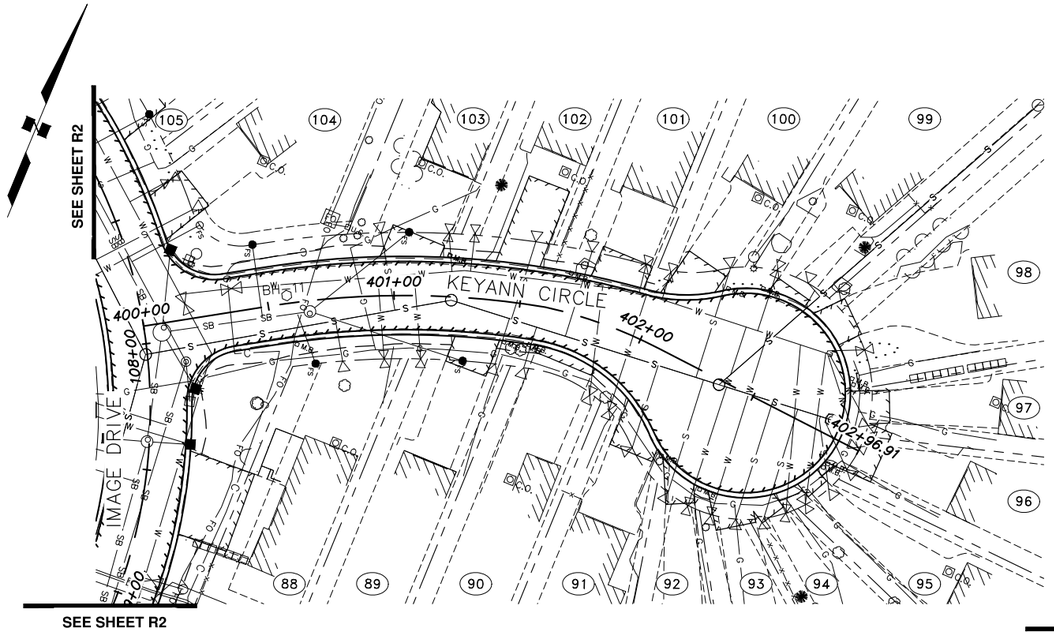
MIRAGE CIRCLE
STA 298+64.50 TO 303+21.12

SCALE HOR. 1"=30'
VER. 1"=3'

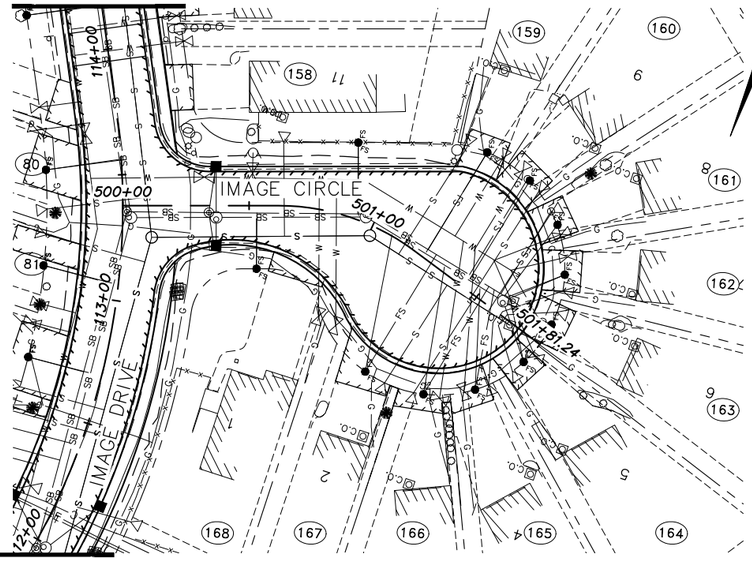
GRID 1627, 1727
DATE DEC 2017
STATUS DSR

SHEET R8 of R10

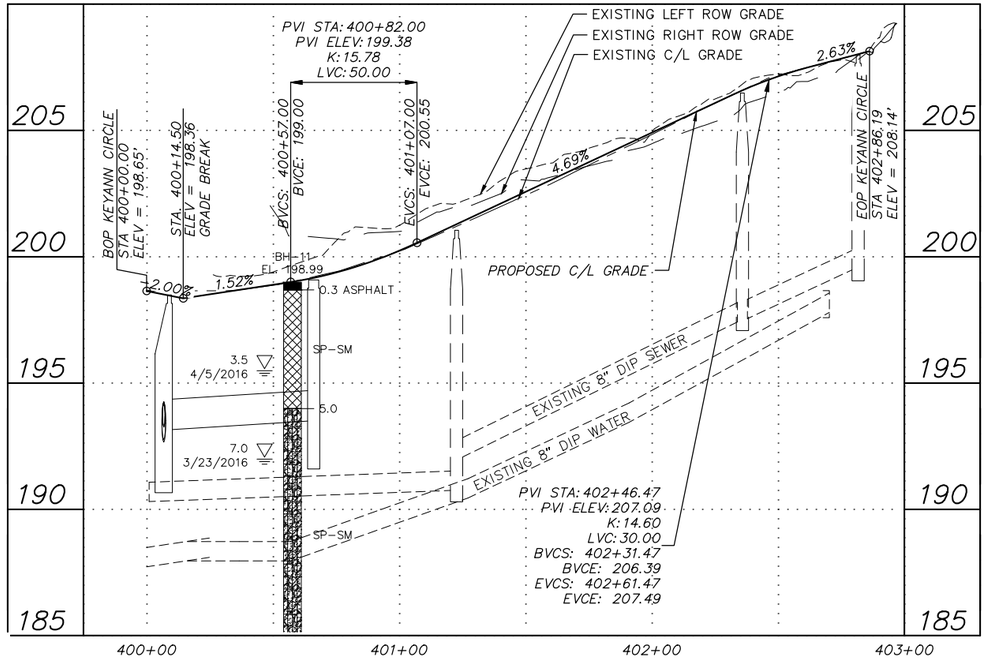
File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Side Streets.dwg

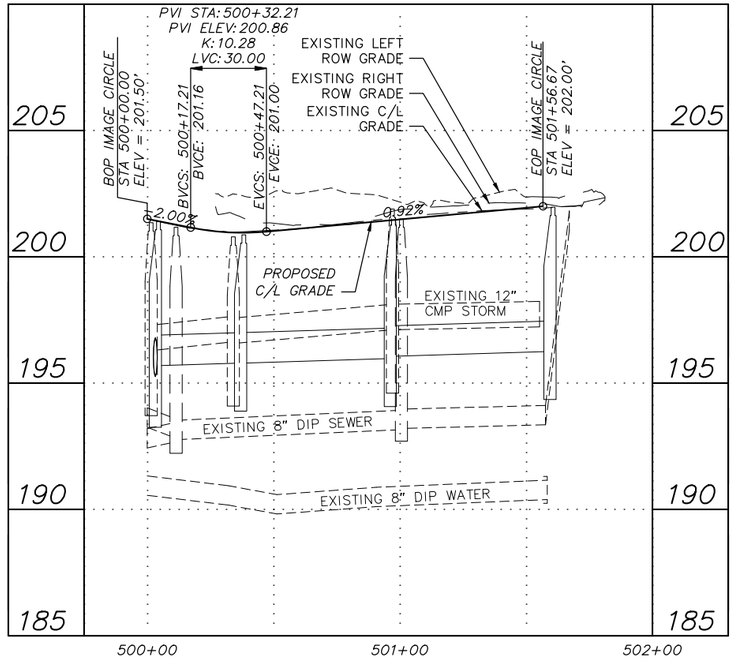


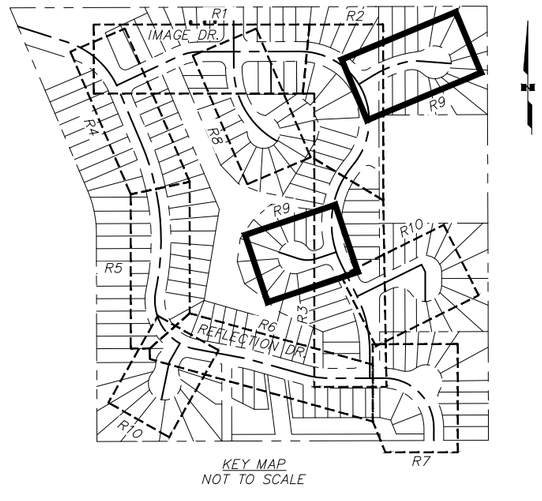
SEE SHEET R2



SEE SHEET R3







KEY MAP
NOT TO SCALE

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 60 30 0 30 60 SCALE

FIELD BOOKS	TBM 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

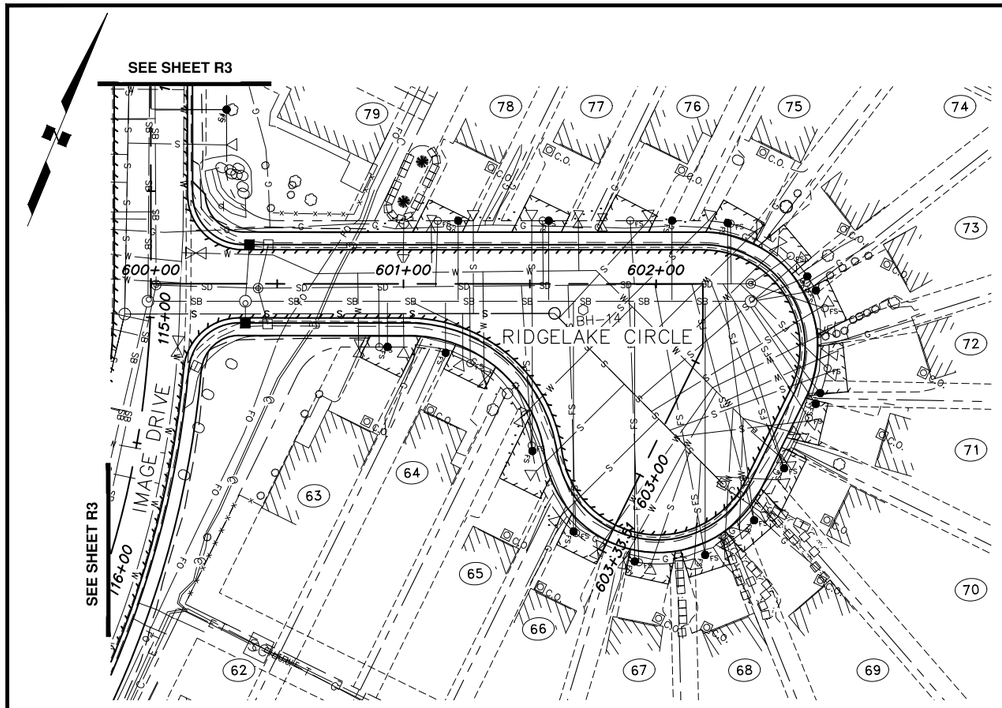
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

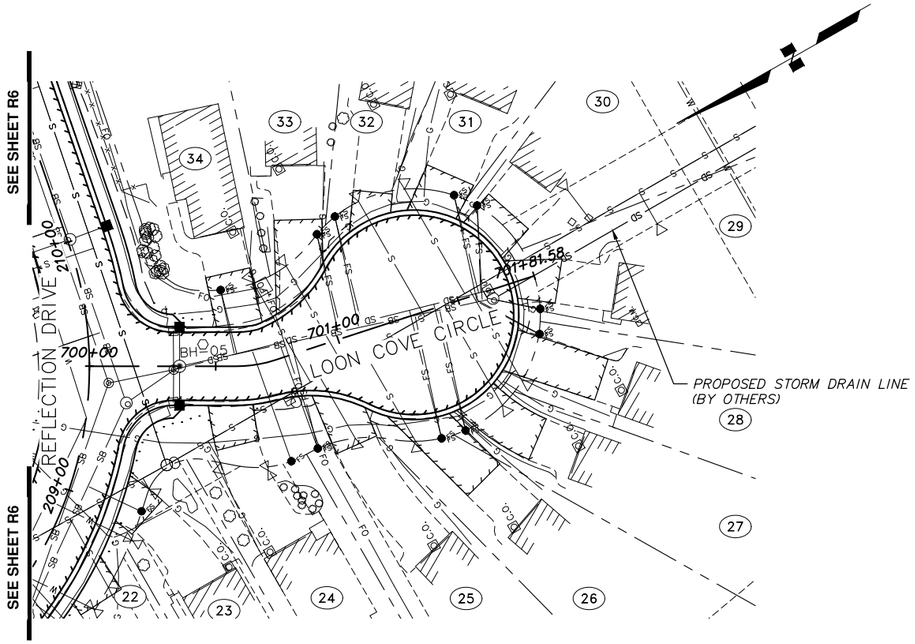
ROADWAY PLAN AND PROFILE

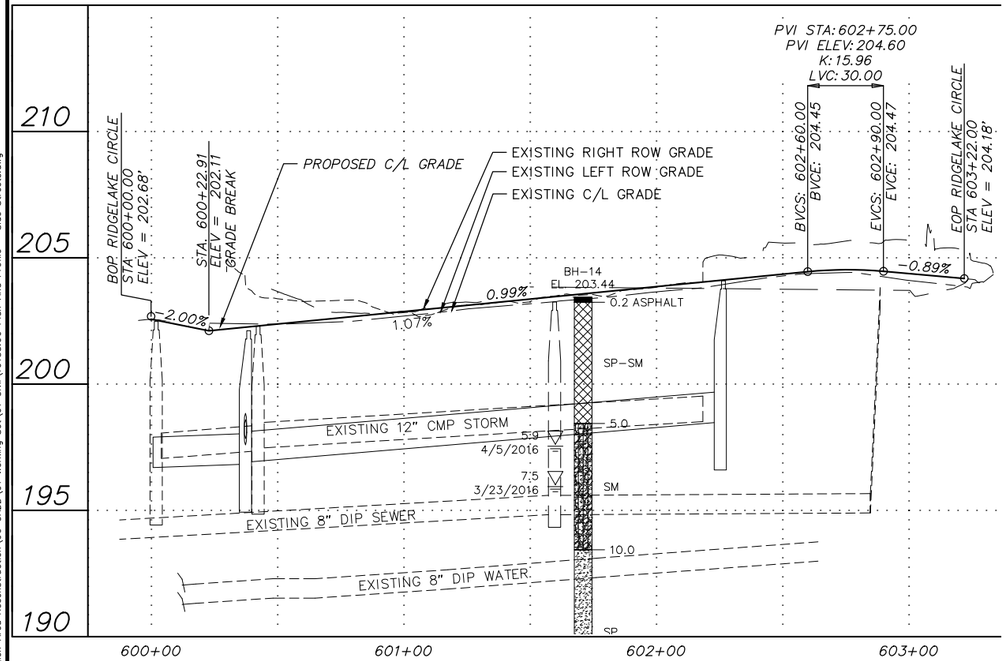
KEYANN CIRCLE – STA 400+00 TO 402+96.19
IMAGE CIRCLE – STA 500+00 TO 501+81.24

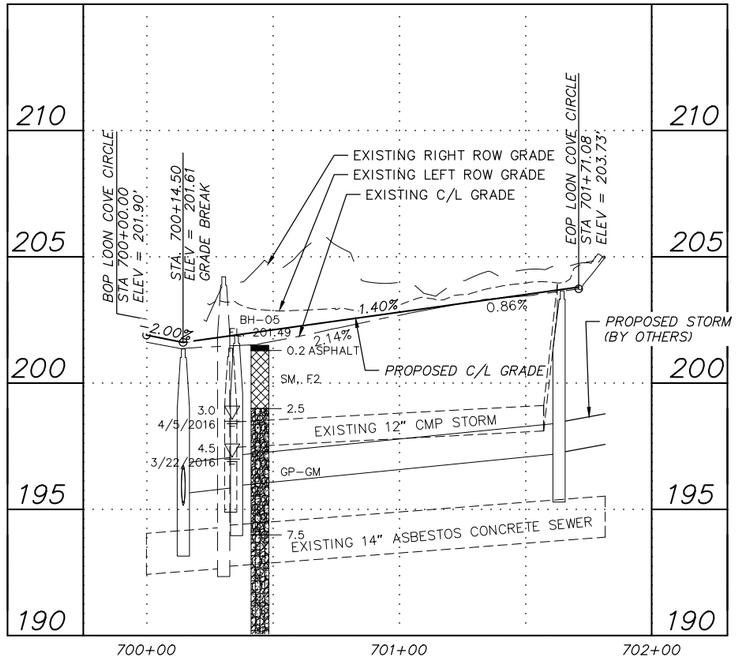
SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET R9 of R10

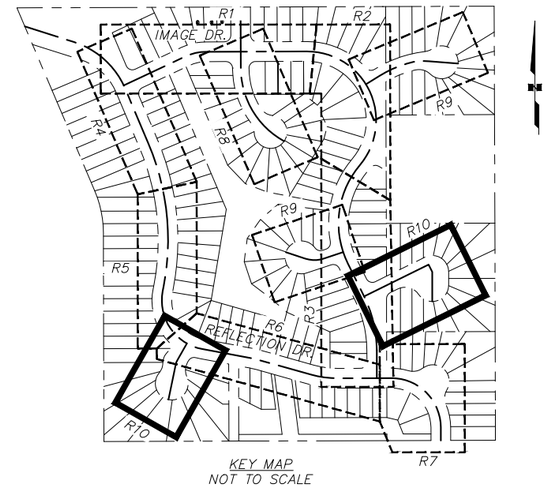
File:J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Side Streets.dwg











RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
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   CONTRACTOR: _____
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   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 60 30 0 30 60

FIELD BOOKS	TBM 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

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCHED A

ROADWAY PLAN AND PROFILE

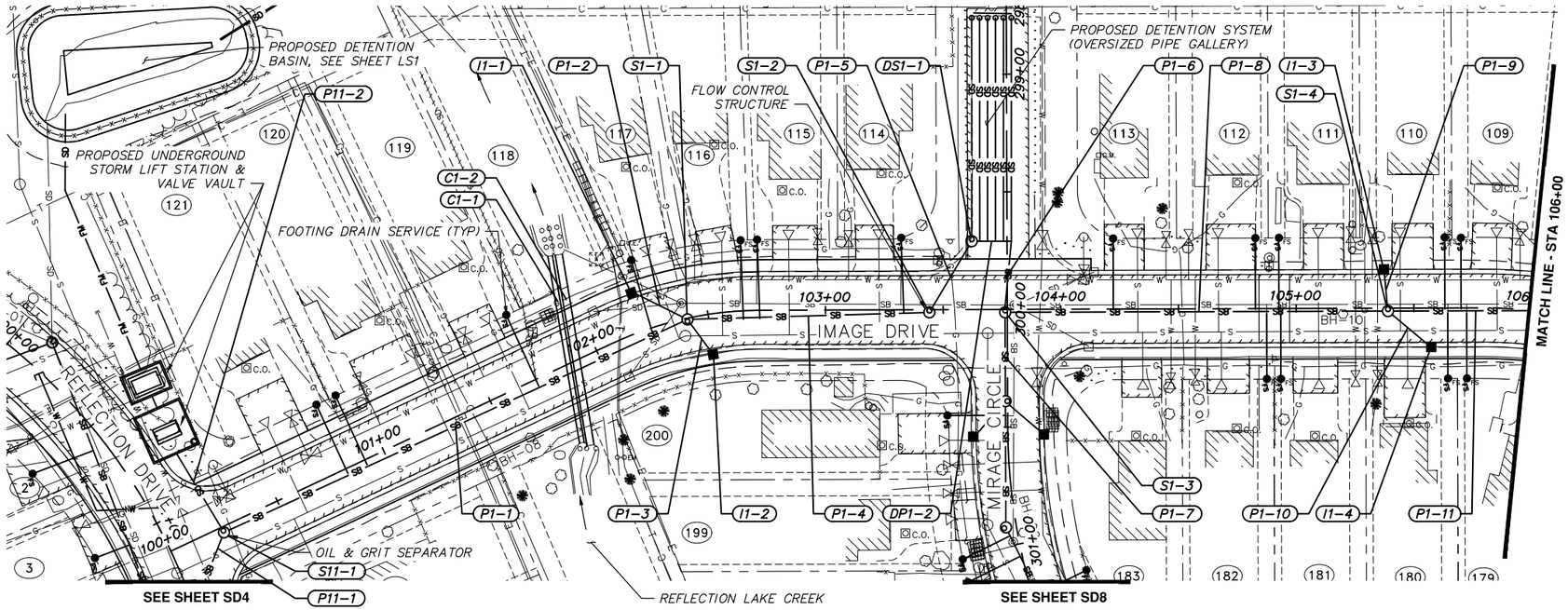
RIDGELAKE CIRCLE – STA 600+00 TO 603+33.61
LOON COVE CIRCLE – STA 700+00 TO 701+81.58

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET R10 of R10

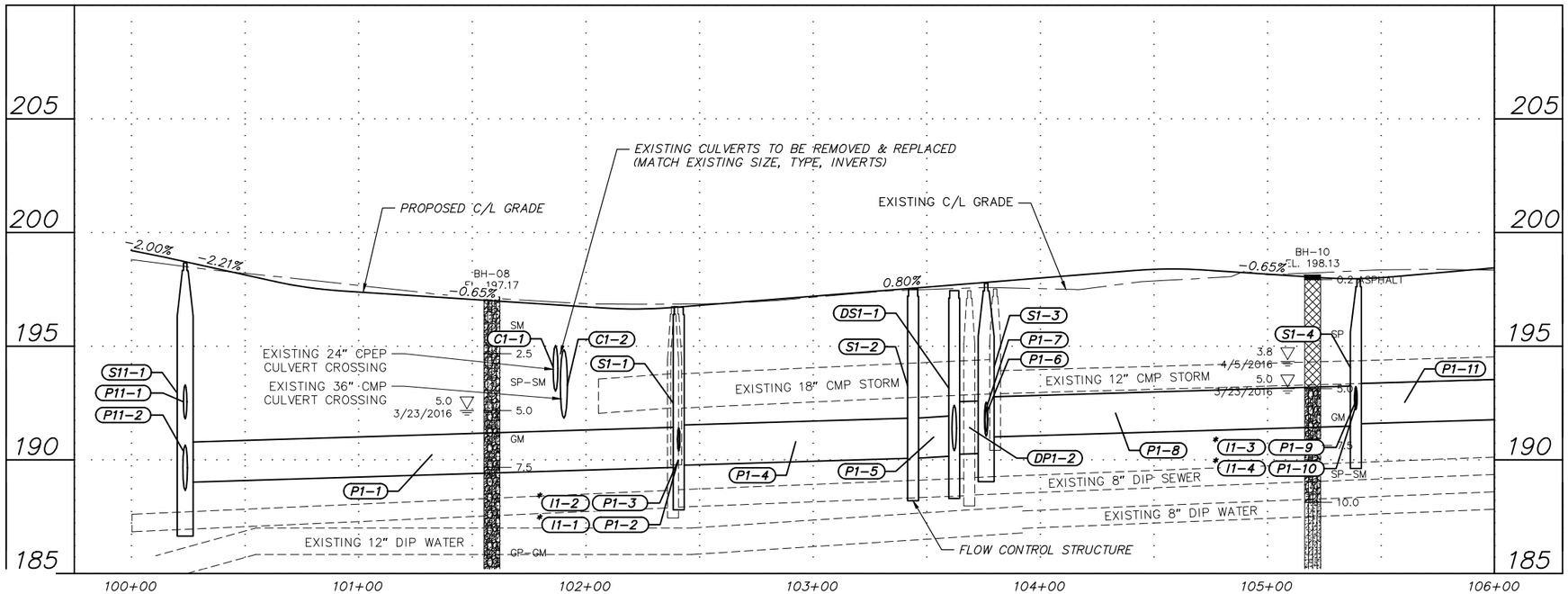
File:J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Side Streets.dwg

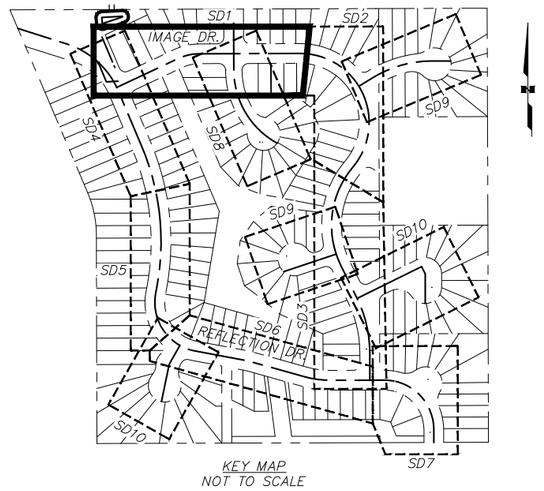
Storm Drain Plan & Profile Drawings

Appendix C



NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.





KEY MAP
NOT TO SCALE

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: _____
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   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 60 30 0 30 60

FIELD BOOKS	TBM 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
@ACLB82-AK

CONSULTANT | SEAL

MUNICIPALITY OF ANCHORAGE

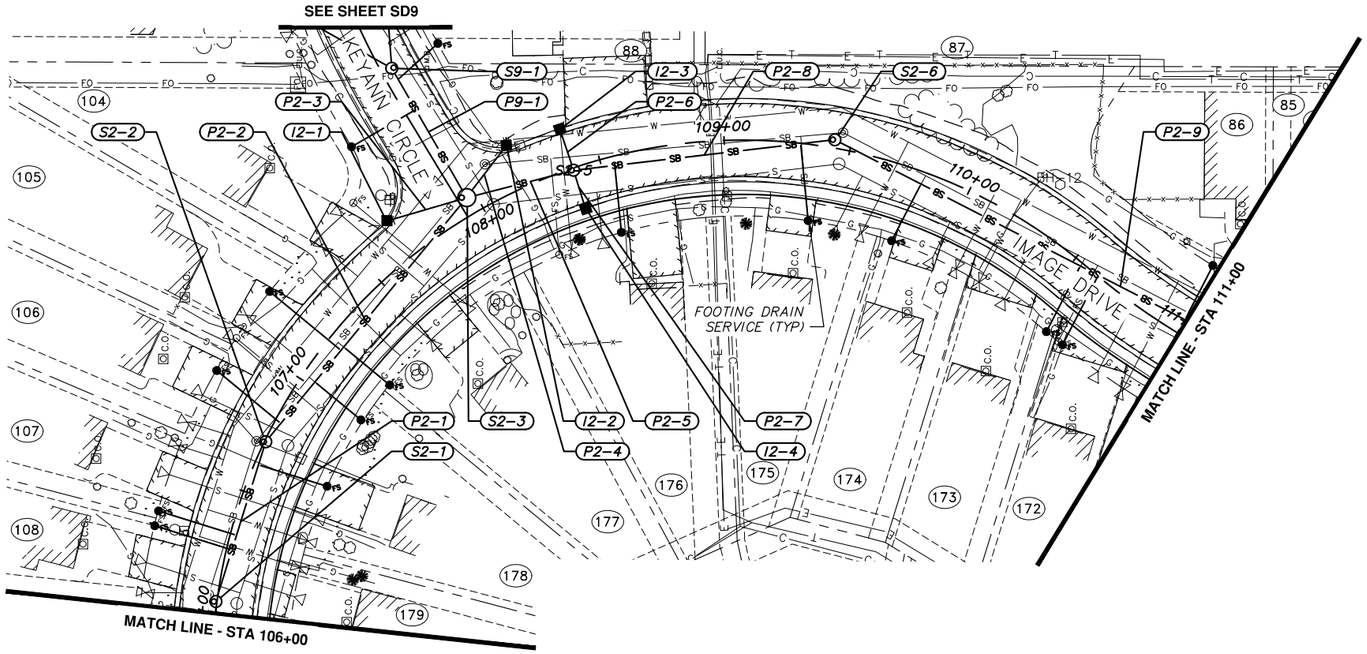
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

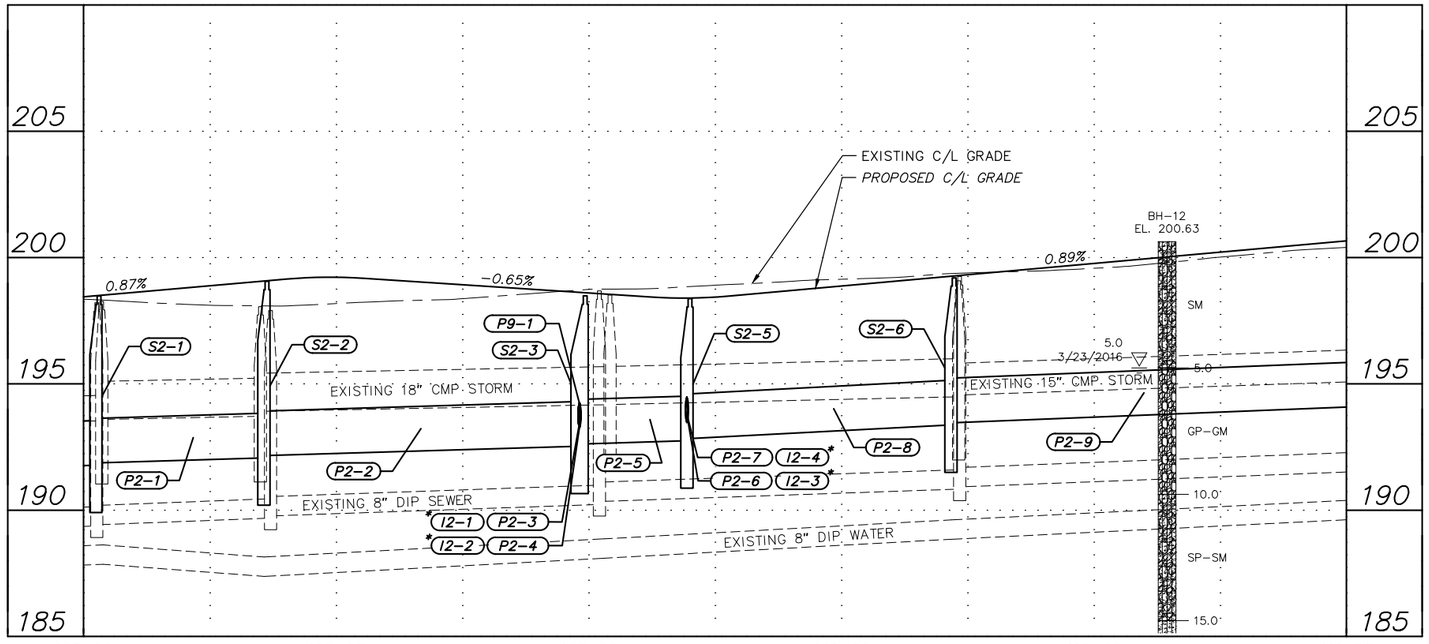
STORM PLAN AND PROFILE

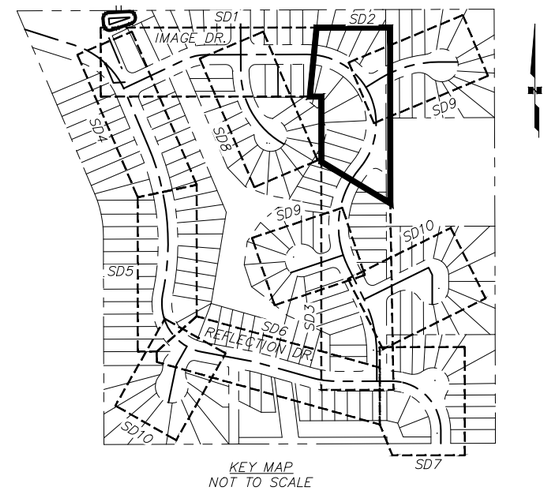
SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD1 of SD10

File: \\crweng.com\Projects\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Storm.dwg



NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.





KEY MAP
NOT TO SCALE

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.
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   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 60 30 0 30 60

FIELD BOOKS	
DESIGN	
STAKING	
ASBUILT	
CONTRACTOR	
INSPECTOR	

CONSTRUCTION RECORD

TBM 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

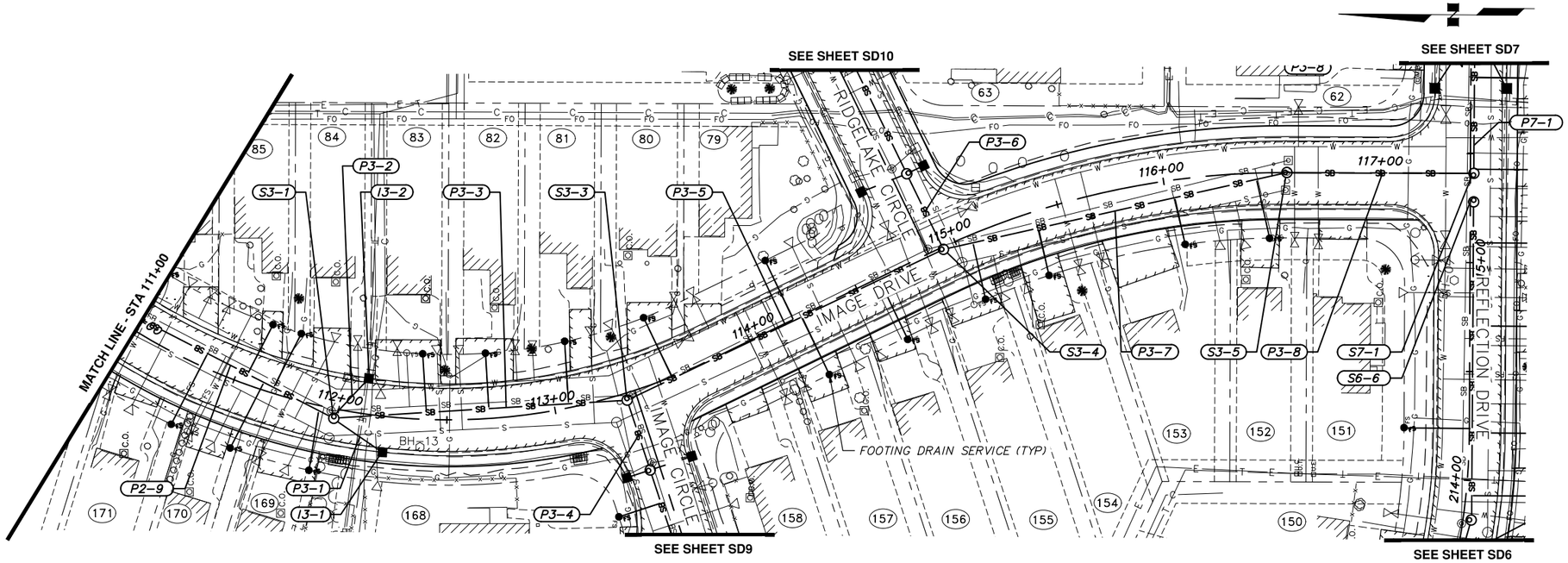
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

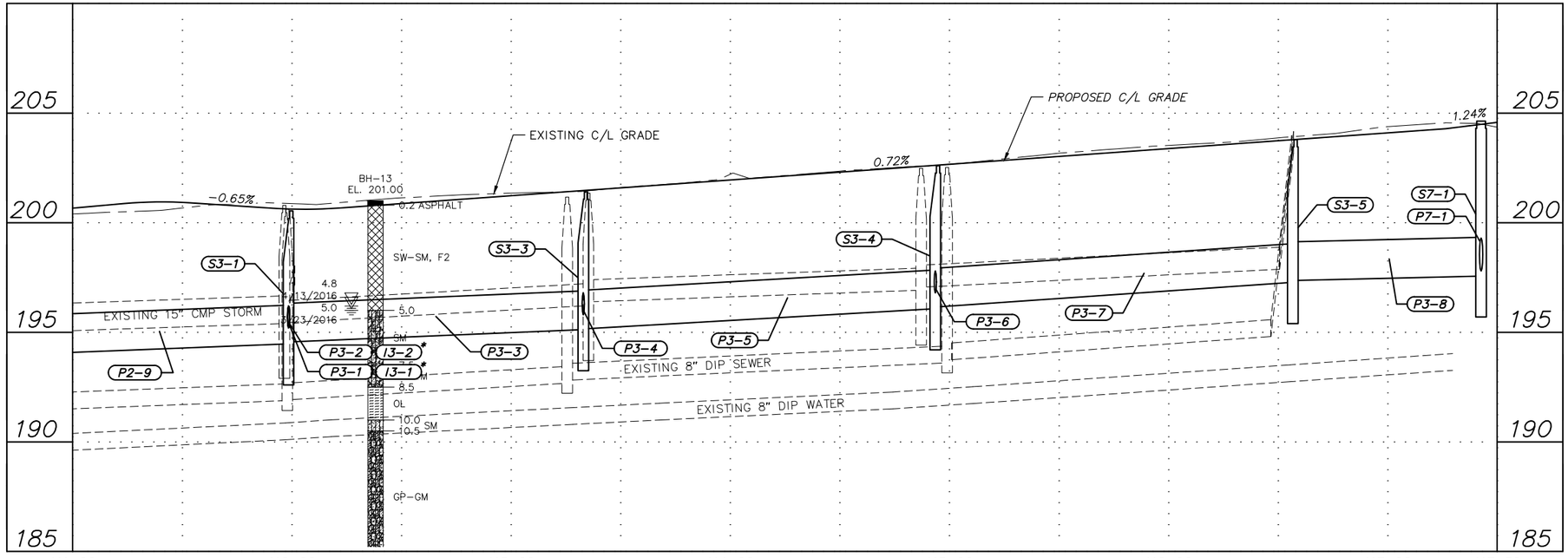
STORM PLAN AND PROFILE

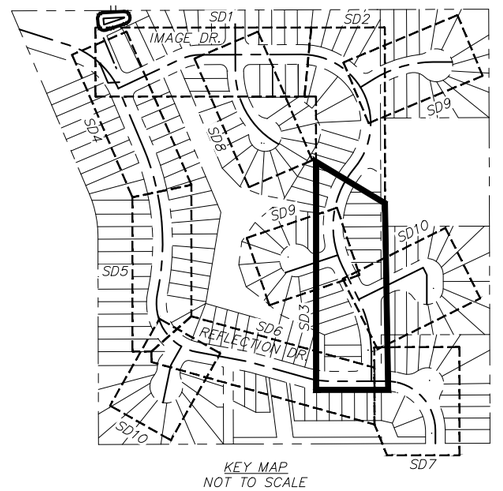
SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD2 of SD10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile — Storm.dwg



NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.





KEY MAP
NOT TO SCALE

RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
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   CONTRACTOR: _____
   BY: _____ TITLE: _____ DATE: _____
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   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	—	—

CONSTRUCTION RECORD

FIELD BOOKS	
DESIGN	
STAKING	
ASBUILT	
CONTRACTOR	
INSPECTOR	

GRAPHIC 60 30 0 30 60 SCALE

VERTICAL DATUM: BASIS OF THIS DATUM

TBM NO.	LOCATION	ELEV.

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

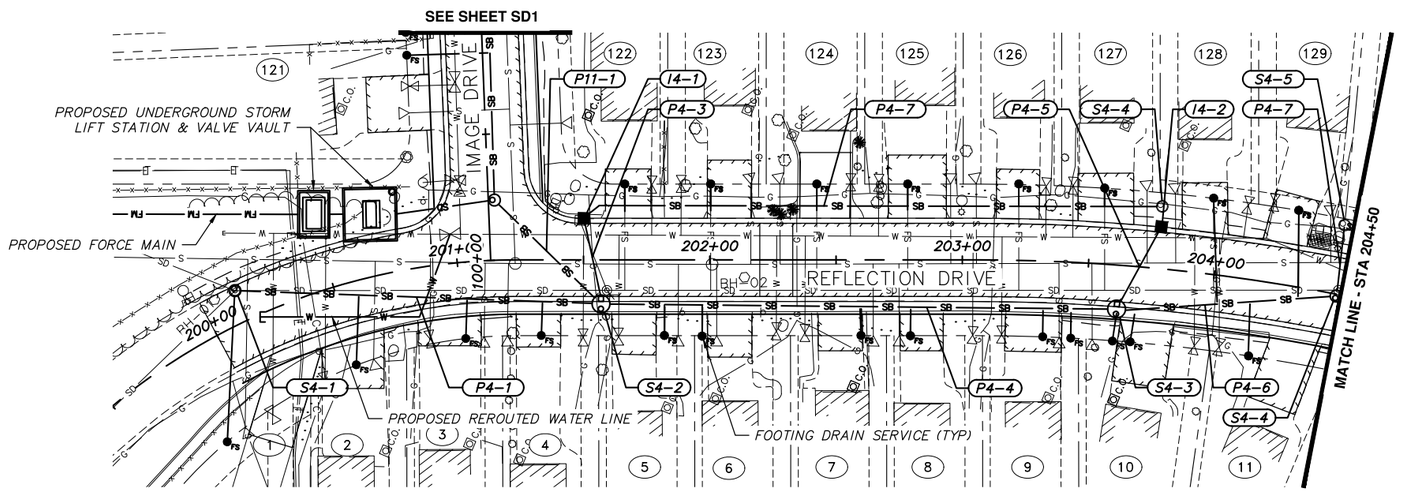
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

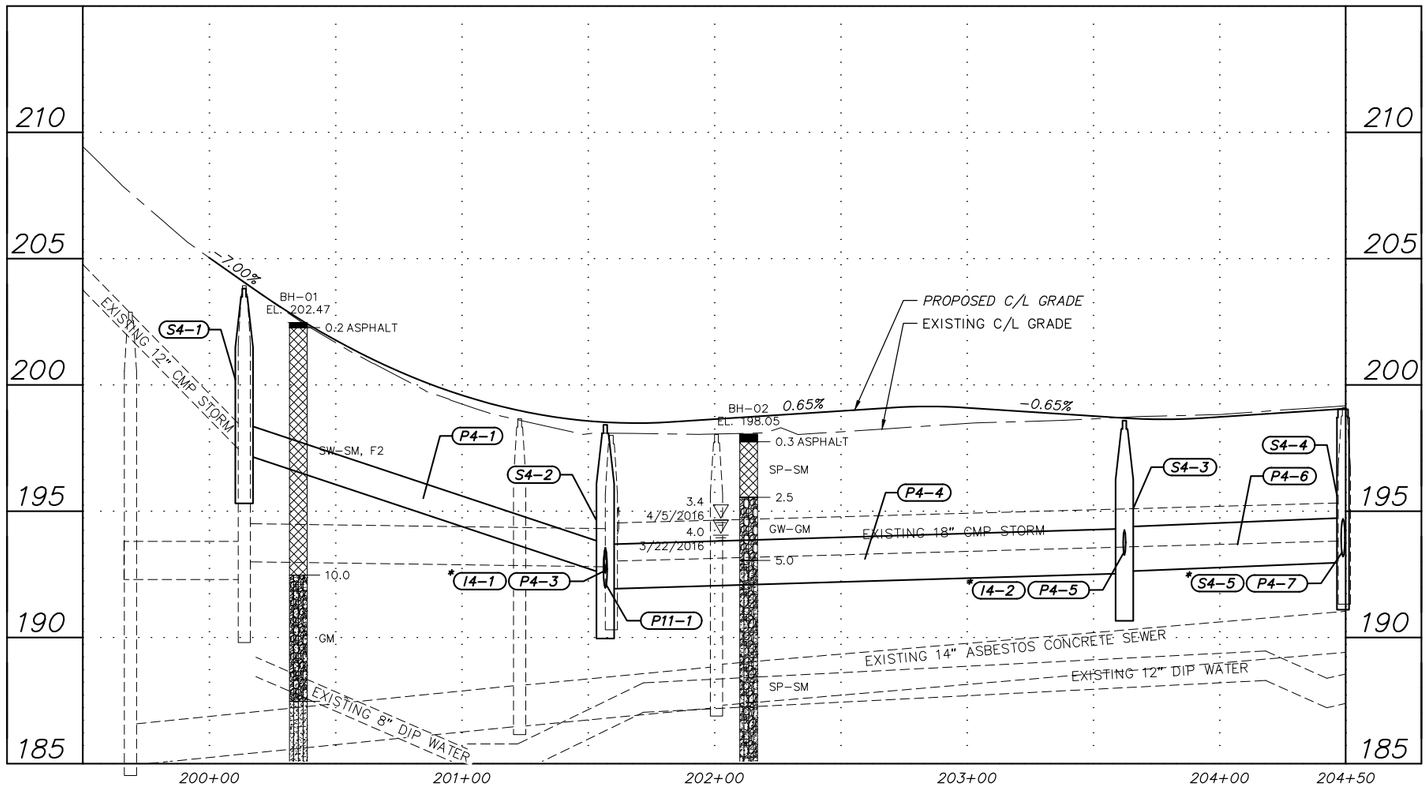
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

STORM PLAN AND PROFILE

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD3 of SD10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Storm.dwg





NOTES:
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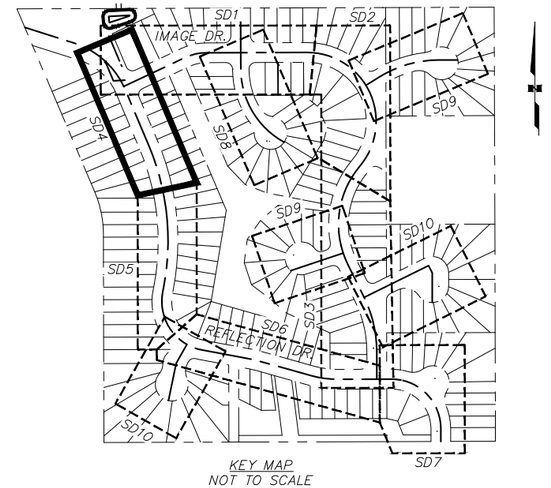

KEY MAP
NOT TO SCALE

RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
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   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 60 30 0 30 60 SCALE

FIELD BOOKS	TBM 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

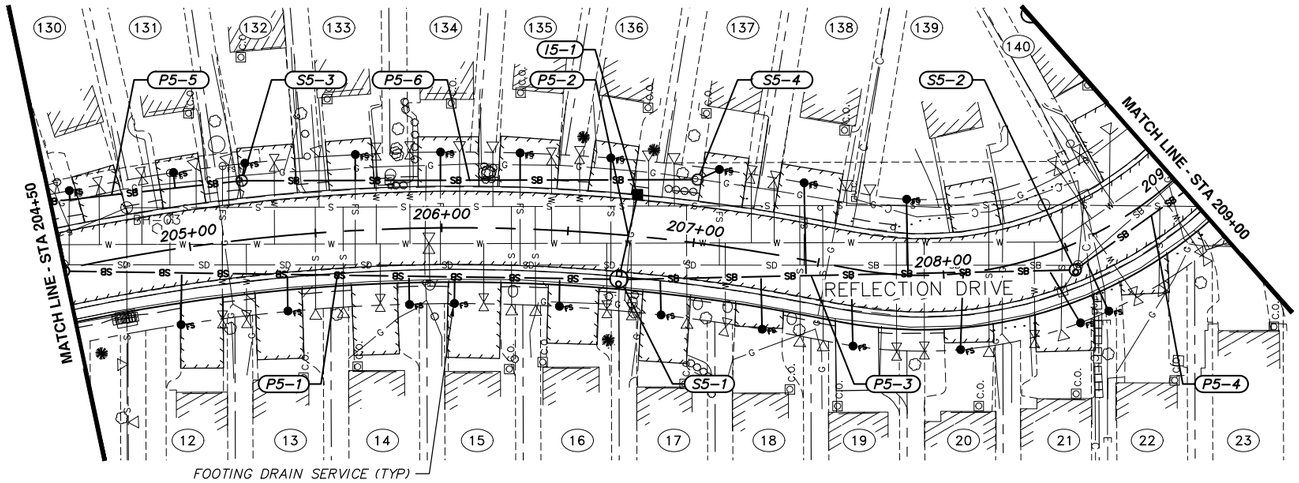
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

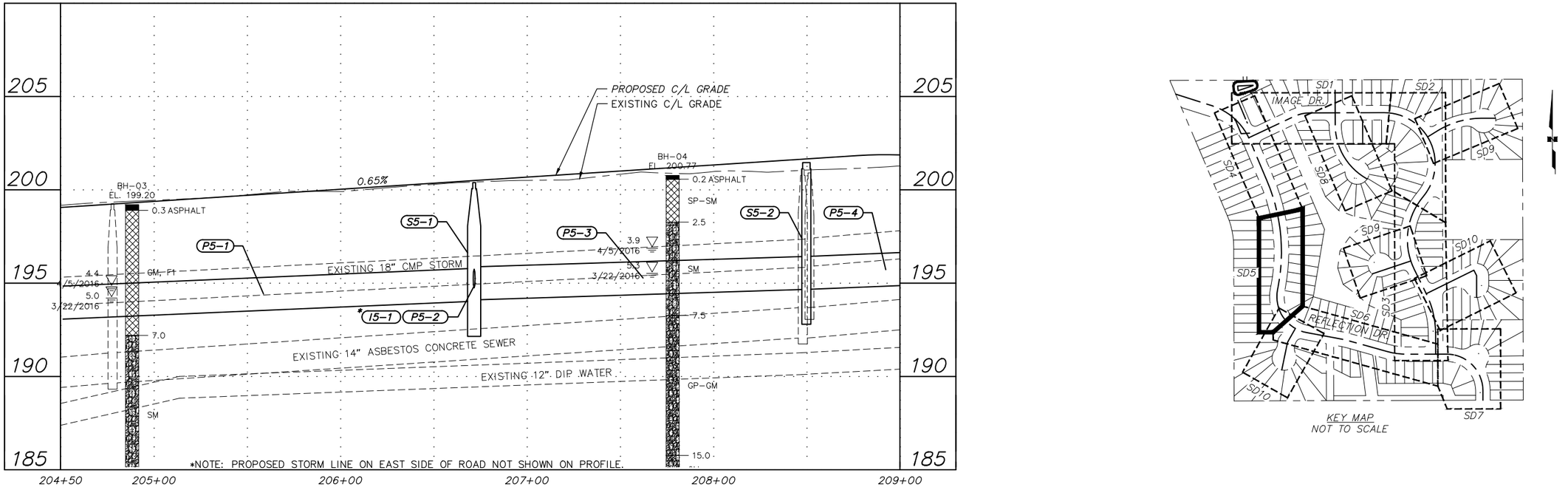
STORM PLAN AND PROFILE

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD4 of SD10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile – Storm.dwg



NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.



KEY MAP
NOT TO SCALE

RECORD DRAWING

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   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 60 30 0 30 60

FIELD BOOKS	TBM 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

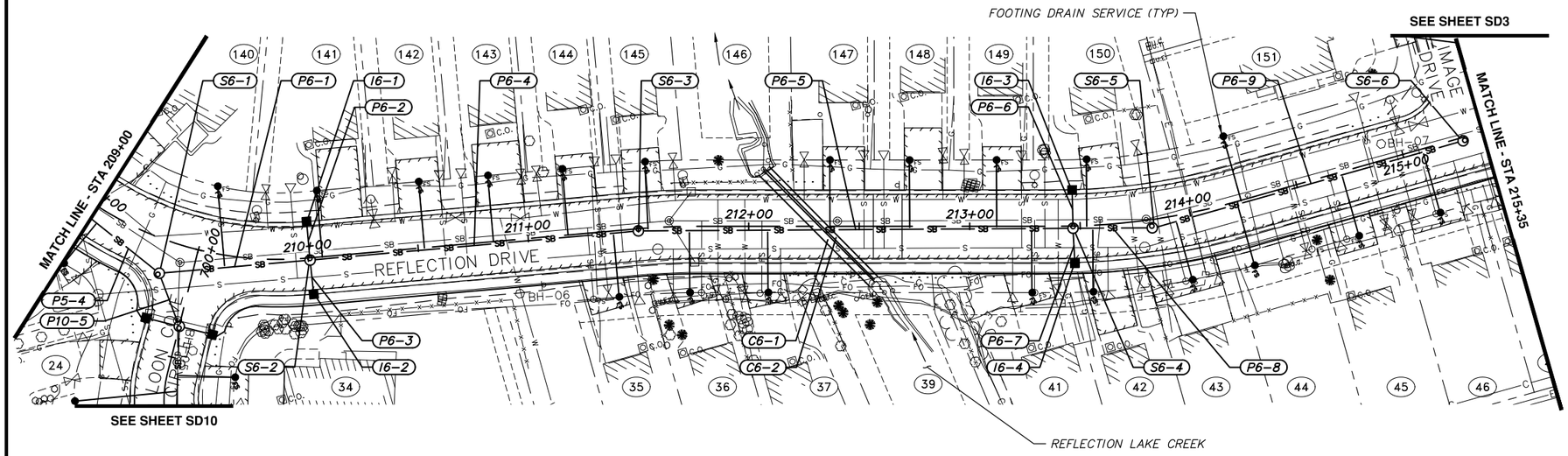
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

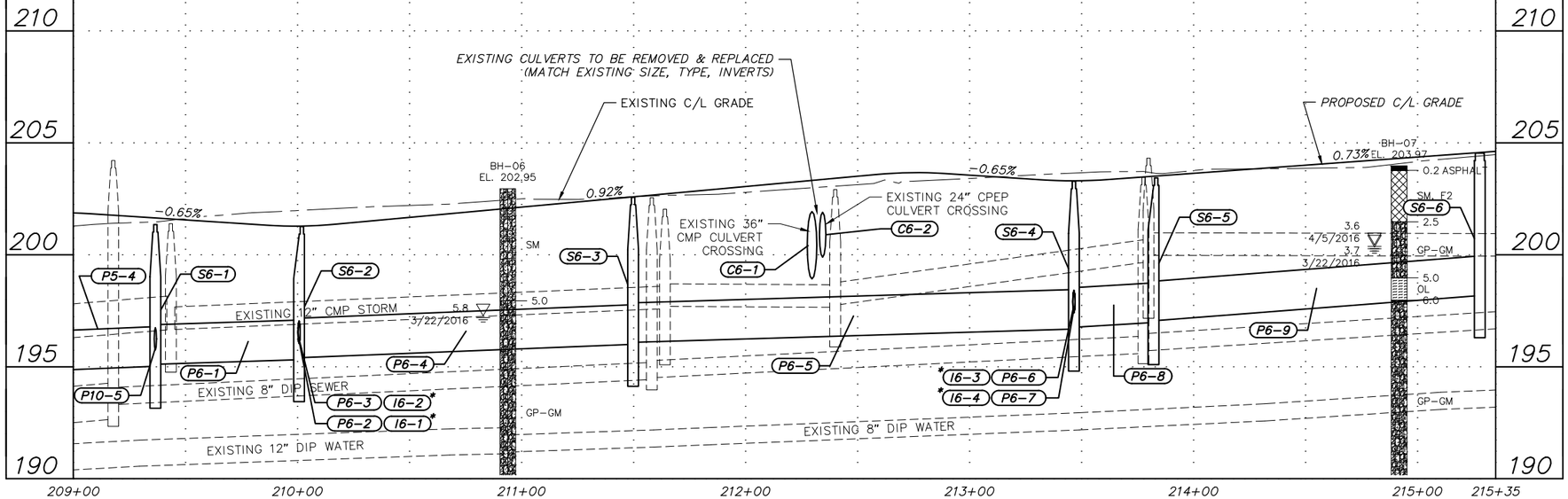
STORM PLAN AND PROFILE

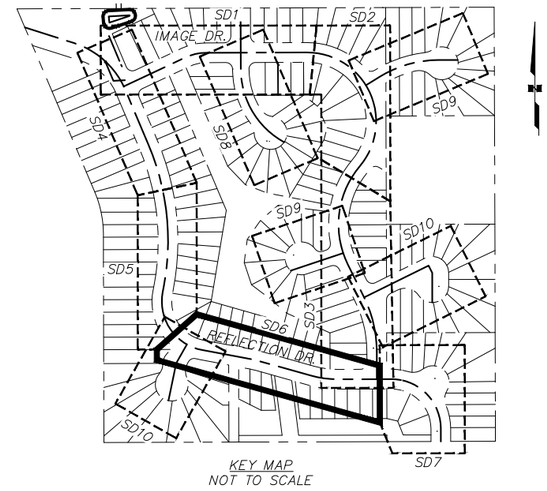
SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD5 of SD10

File: J:\Jobs\Data\Y0133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\Y0133.00 Plan And Profile - Storm.dwg



NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.





KEY MAP
NOT TO SCALE

RECORD DRAWING

1. DATA PROVIDED BY: _____ TITLE: _____
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2. DATA TRANSFERRED BY: _____ TITLE: _____
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   COMPANY: _____ DATE: _____
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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 60 30 0 30 60

FIELD BOOKS	TBM 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

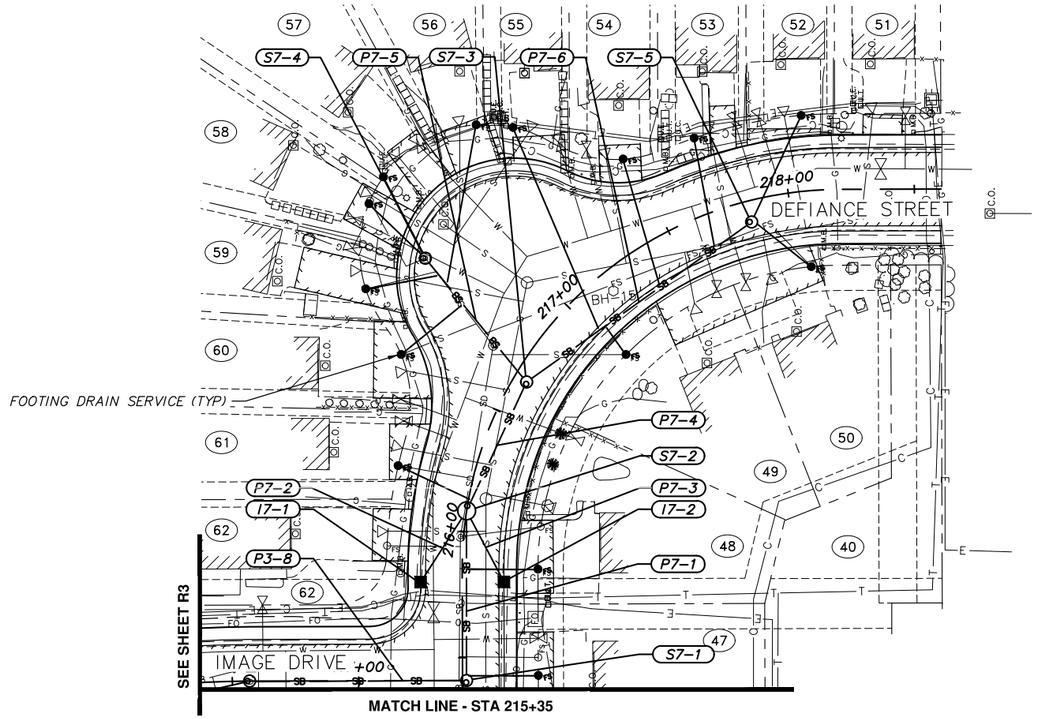
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

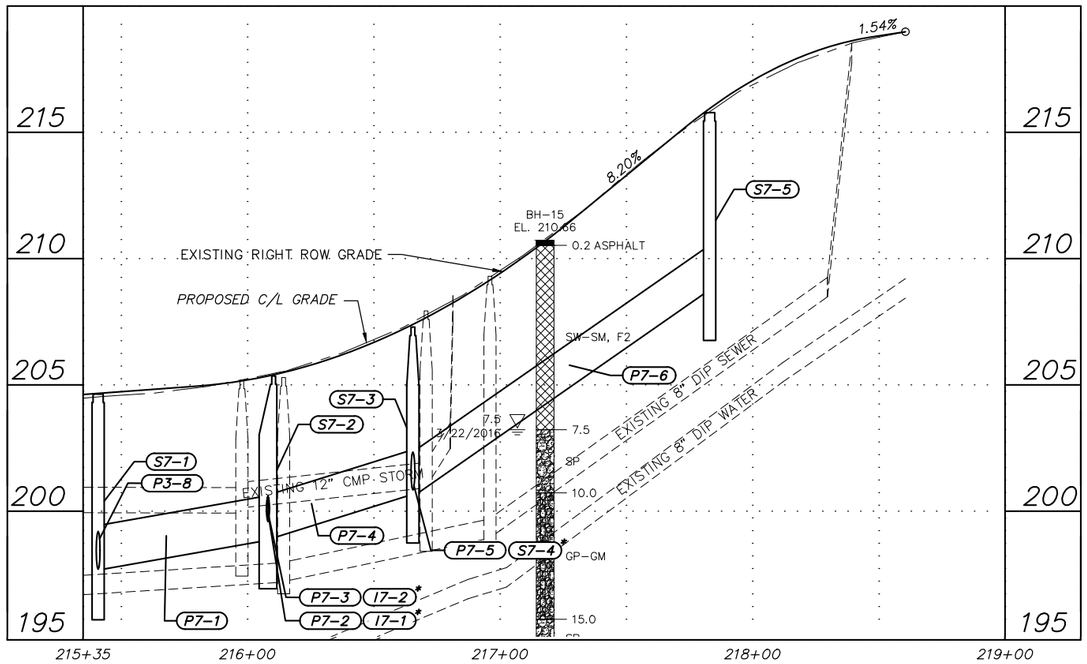
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

STORM PLAN AND PROFILE

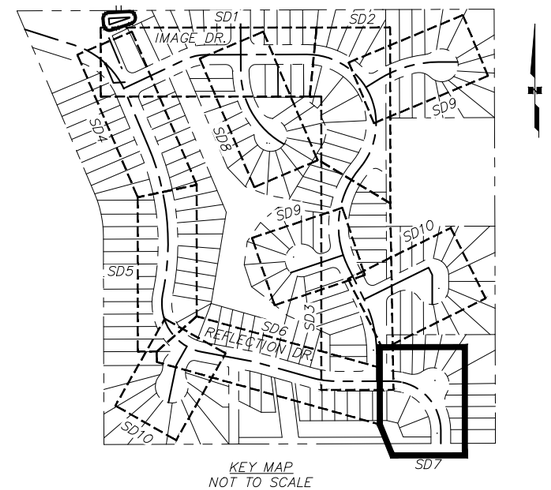
SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD6 of SD10

File: \\crweng.com\Projects\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile – Storm.dwg





NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.



KEY MAP
NOT TO SCALE

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: _____
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   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 60 30 0 30 60

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

CONSTRUCTION RECORD | VERTICAL DATUM

REV	DATE	DESCRIPTION	BY

REVISIONS

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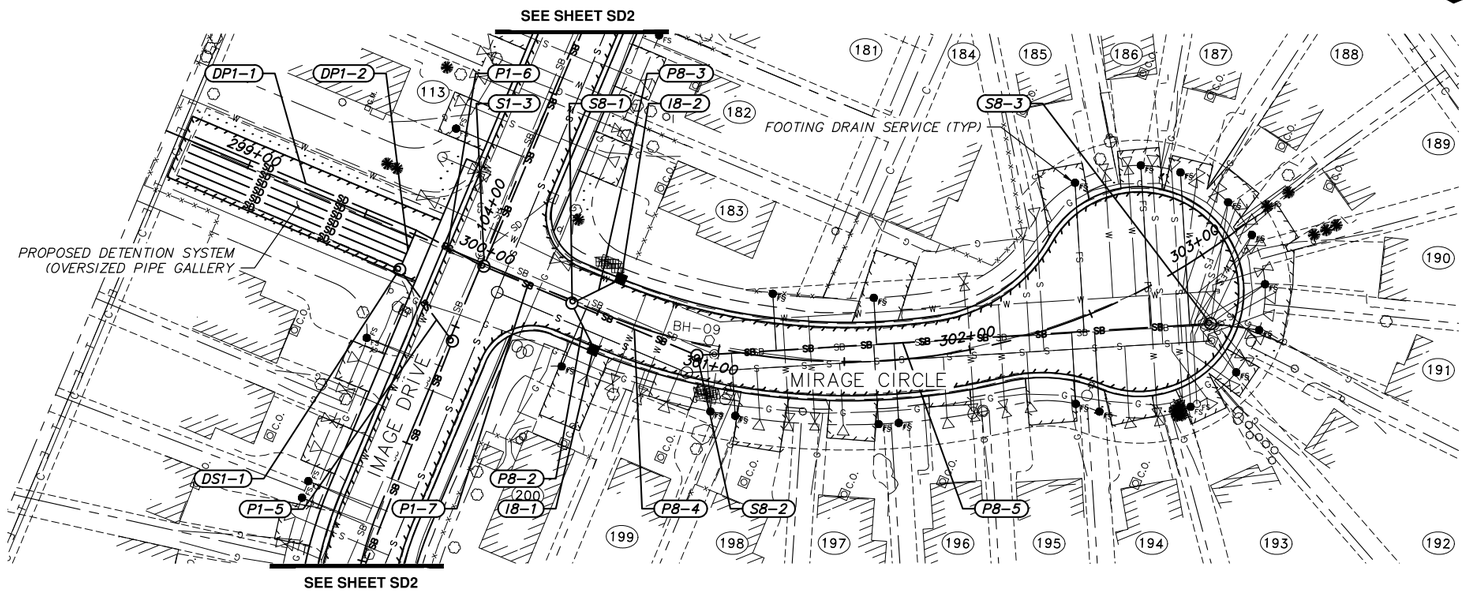
PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

STORM PLAN AND PROFILE

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD7 of SD10

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Storm.dwg



NOTES:
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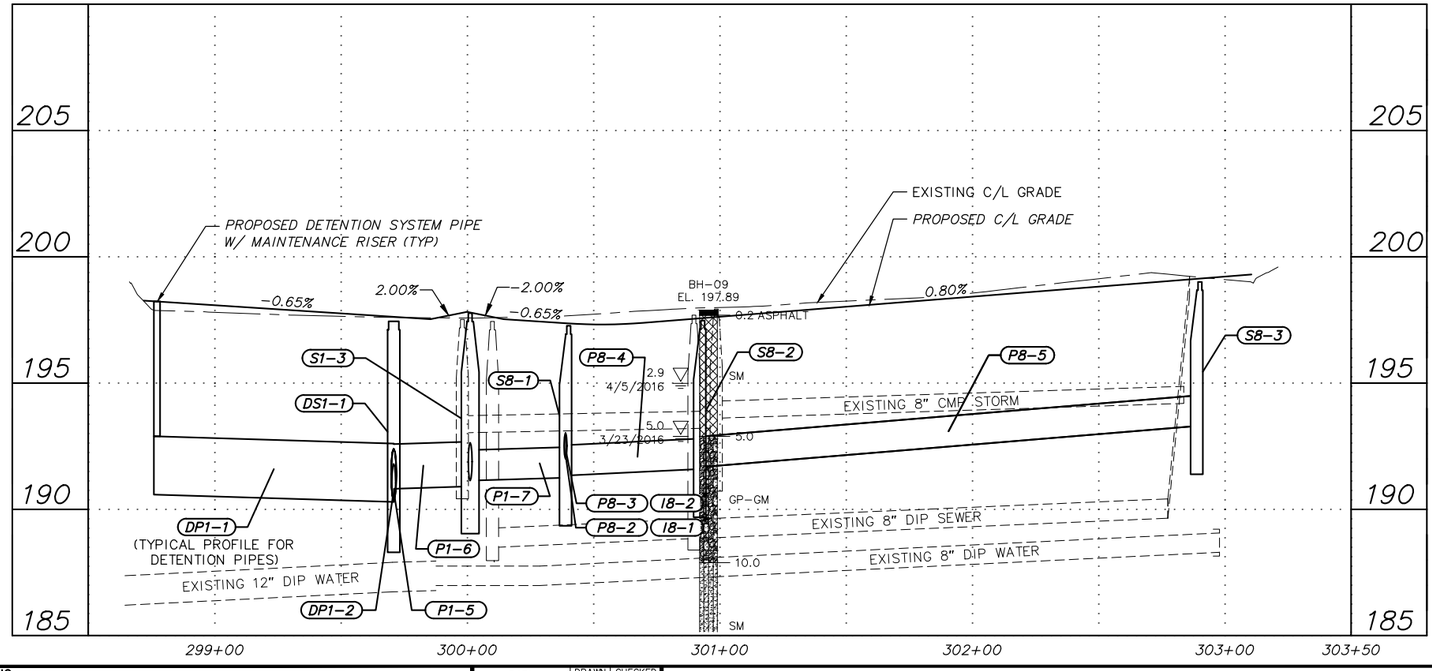

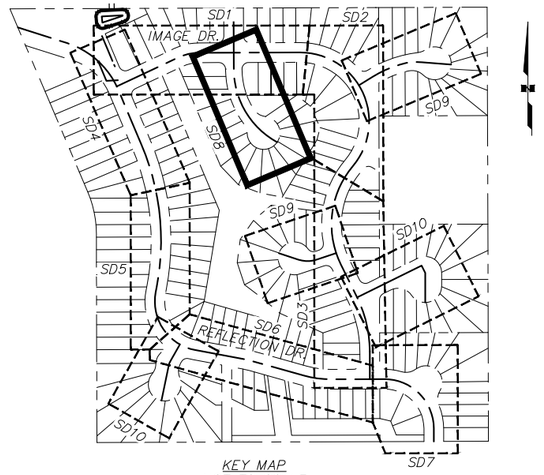

KEY MAP
NOT TO SCALE

RECORD DRAWING

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   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 60 30 0 30 60

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

REV	DATE	DESCRIPTION	BY
REVISIONS			

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SEAL

UNIVERSITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

STORM PLAN AND PROFILE

SCALE HOR. 1"=30'
VER. 1"=3'
GRID 1627, 1727
DATE DEC 2017
STATUS DSR
SHEET SD8 of SD10

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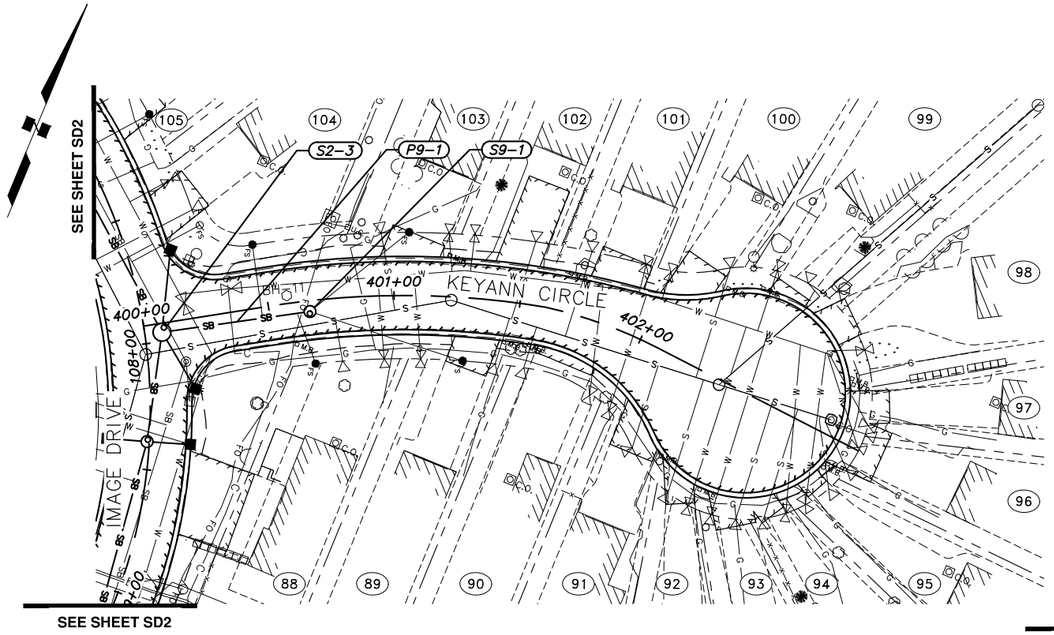

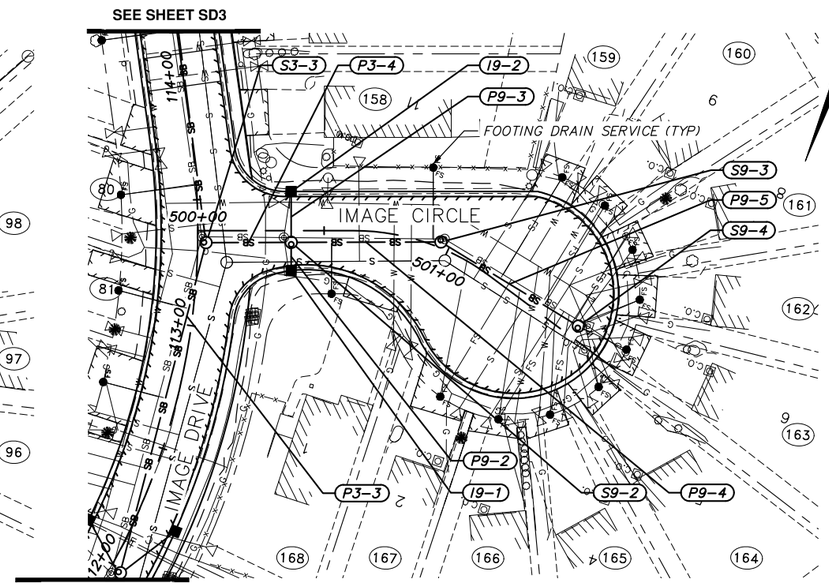

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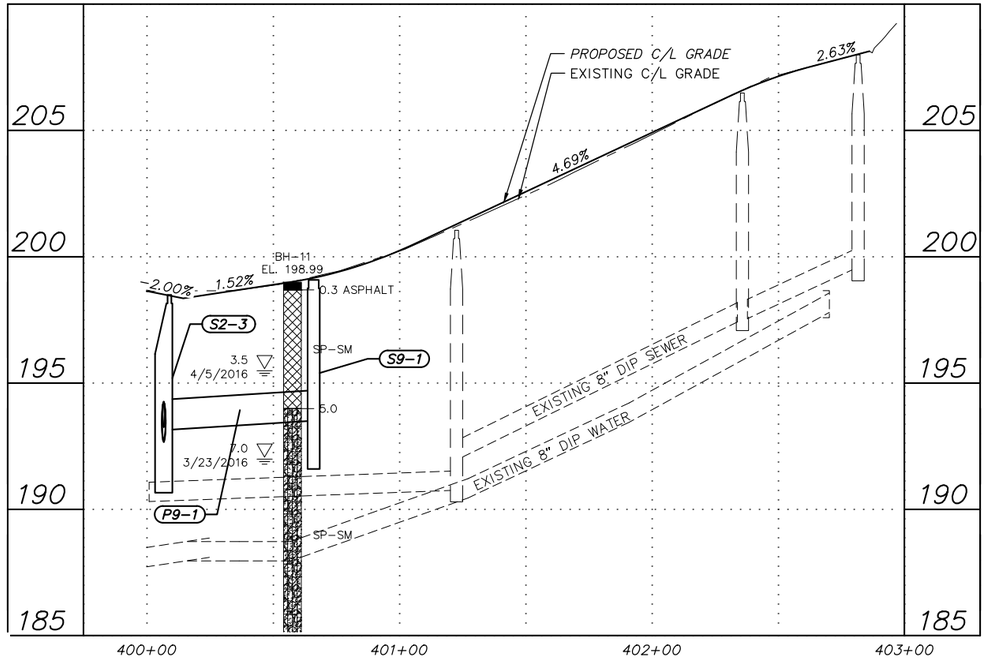
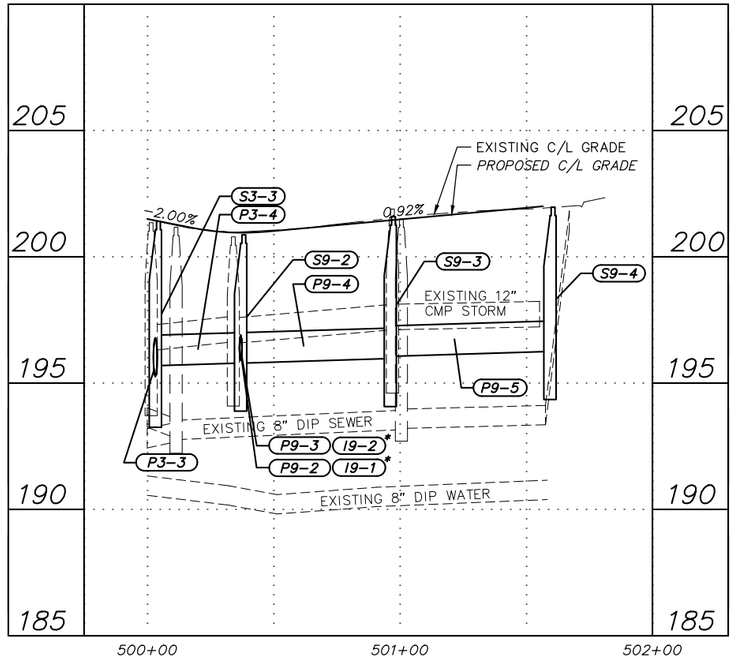
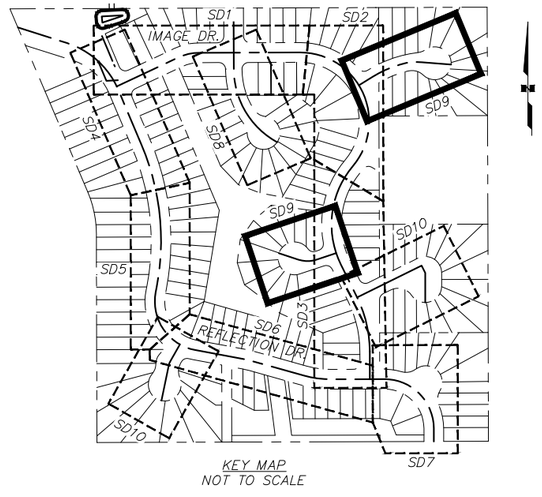
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.







KEY MAP
NOT TO SCALE

RECORD DRAWING

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   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 60 30 0 30 60 SCALE

FIELD BOOKS	TBM 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
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PHONE: (907) 562-3252
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CONSULTANT

SEAL

UNIVERSITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

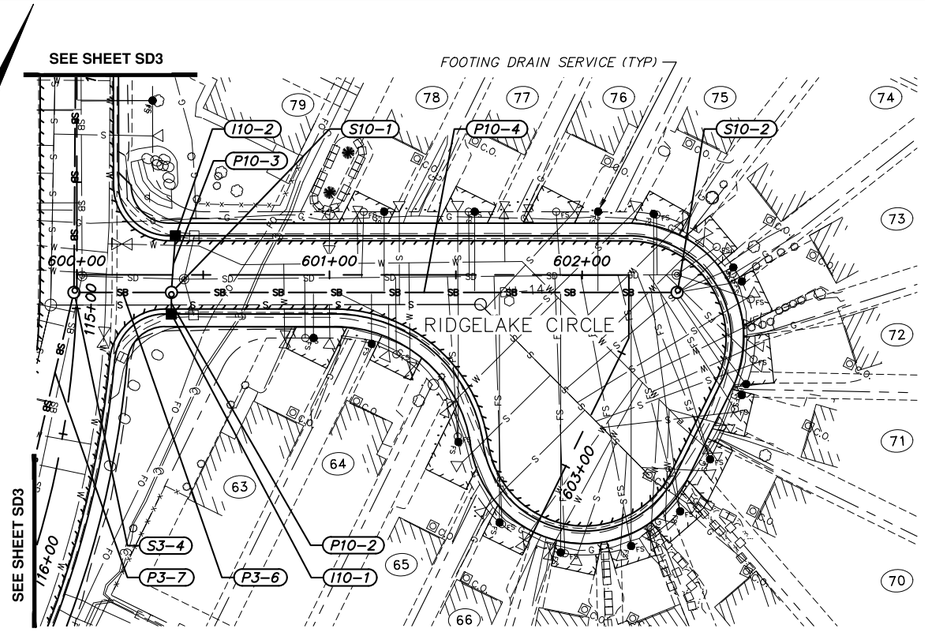
14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

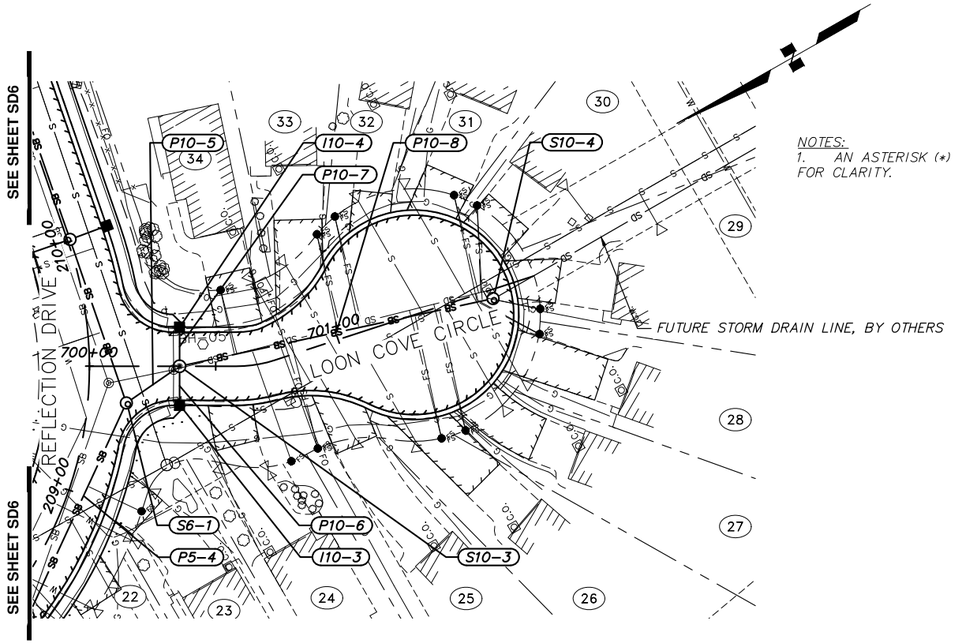
STORM PLAN AND PROFILE

KEYANN CIRCLE – STA 400+00 TO 402+86.19
IMAGE CIRCLE – STA 500+00 TO 501+56.67

SCALE HOR. 1"=30' VER. 1"=3' | GRID 1627, 1727 | DATE DEC 2017 | STATUS DSR | SHEET SD9 of SD10

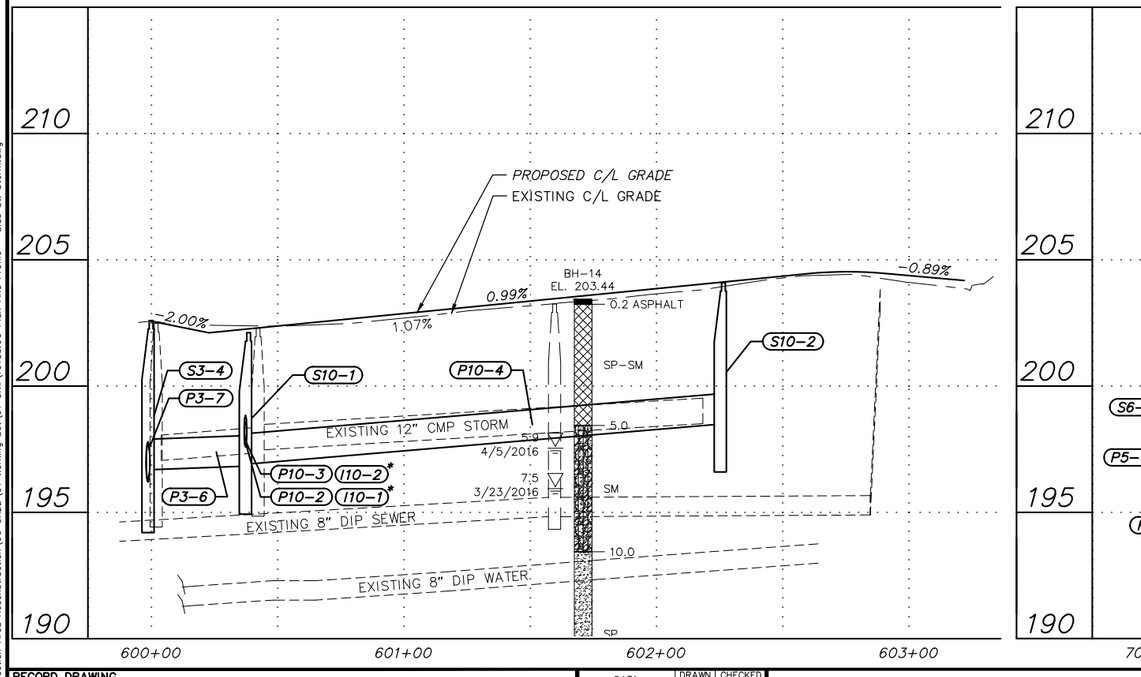
File:J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Side St. Storm.dwg

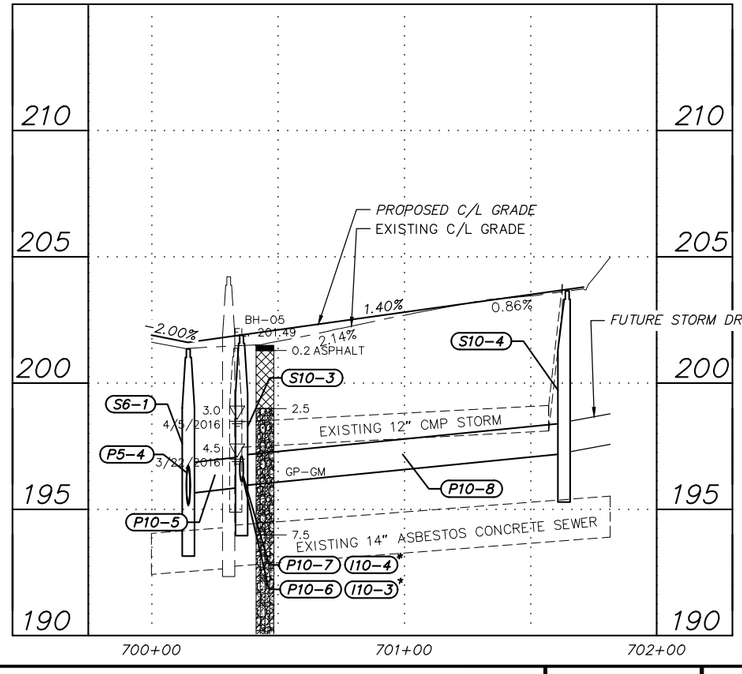




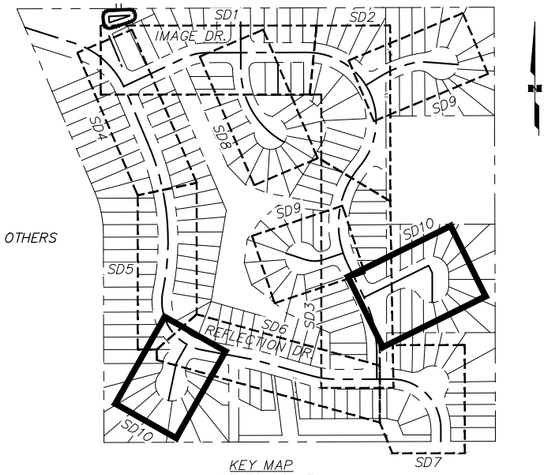
FUTURE STORM DRAIN LINE, BY OTHERS

NOTES:
1. AN ASTERISK (*) DENOTES PIPE OR STRUCTURE NOT SHOWN IN PROFILE FOR CLARITY.





FUTURE STORM DRAIN LINE, BY OTHERS



KEY MAP
NOT TO SCALE

RECORD DRAWING

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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 60 30 0 30 60

FIELD BOOKS	TBM NO.	LOCATION	ELEV.
DESIGN			
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INSPECTOR			
CONSTRUCTION RECORD	VERTICAL DATUM		

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UNIVERSITY OF ANCHORAGE

PROJECT MANAGEMENT AND ENGINEERING DEPARTMENT

14-50 IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION SCH.

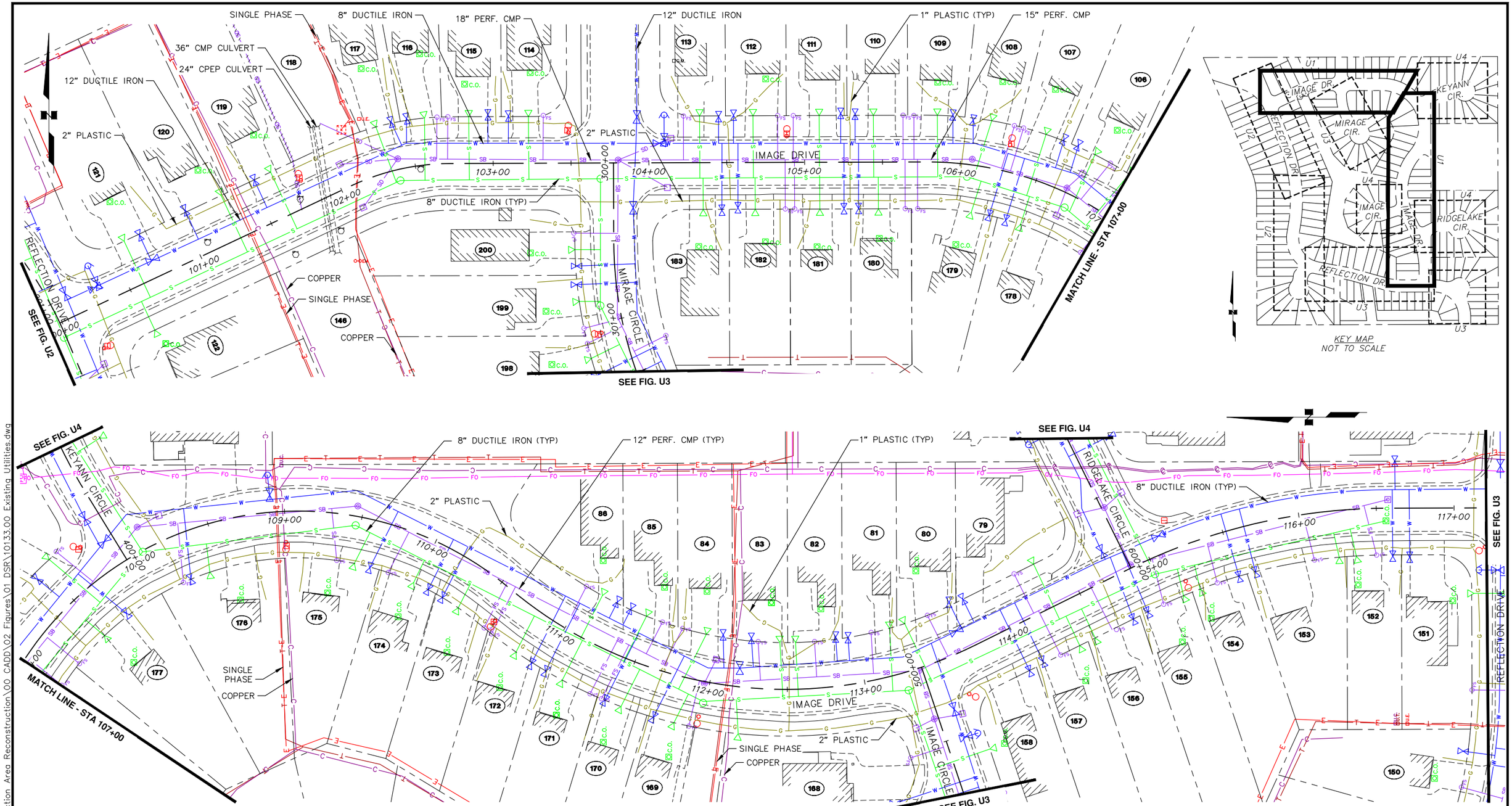
STORM PLAN AND PROFILE

SCALE HOR. 1"=30'
VER. 1"=3'
GRID 1627, 1727
DATE DEC 2017
STATUS DSR
SHEET SD10 of SD10

File:J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Plan And Profile - Side St. Storm.dwg

Existing Utilities Drawings

Appendix D



EXISTING UTILITY LEGEND

W — WATER	U.E. ELECTRIC PEDESTAL
S — SEWER	EM ELECTRIC METER
G — NATURAL GAS	U.T. TELEPHONE PEDESTAL
FO — FIBER OPTIC	U.C. CABLE TV PEDESTAL
E — ELECTRIC	JUNCTION BOX TYPE 1 (LIGHTING/TRAFFIC)
T — TELEPHONE	FO FIBER OPTIC VAULT
C — CABLE TELEVISION	STORM DRAIN CATCH BASIN
SD — STORM DRAIN	STORM DRAIN MANHOLE
FS — STORM FOOTING DRAIN	G.M. GAS METER
SB — SUBDRAIN	UTILITY POLE
	LOAD CENTER
	LIGHT POLE
	GUY WIRE
	KEY BOX
	WATER VALVE
	FIRE HYDRANT
	SANITARY SEWER SERVICE
	SANITARY SEWER MANHOLE
	C.O. SANITARY SEWER CLEANOUT
	FS FOOTING DRAIN SERVICE
	XX PARCEL NUMBER

30 0 15 30 60
GRAPHIC SCALE

PROJECT: 10133.00
STATUS: DRAFT DSR

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MUNICIPALITY OF ANCHORAGE

IMAGE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION
PM&E PROJECT NO. 14-50

EXISTING UTILITIES

IMAGE DRIVE

DATE: DEC 2017
SCALE: GRAPHIC
FIGURE: U1

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\10133.00 Existing Utilities.dwg

SEE FIG. U1

12" DUCTILE IRON (TYP)

IMAGE DRIVE

REFLECTION DRIVE

2" PLASTIC

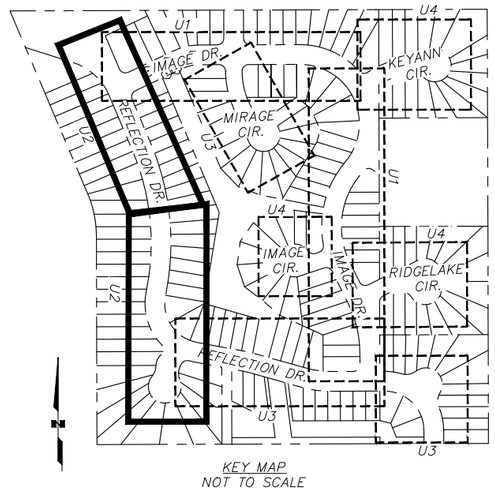
14" ASBESTOS CONCRETE (TYP)

18" CMP (TYP)

COPPER

SINGLE PHASE

MATCH LINE - STA 205+00



KEY MAP
NOT TO SCALE

SEE FIG. U3

12" DUCTILE IRON (TYP)

2" PLASTIC

14" ASBESTOS CONCRETE

18" CMP (TYP)

18" PERF. CMP (TYP)

1" PLASTIC (TYP)

SINGLE PHASE

MATCH LINE - STA 205+00

LOON COVE CIRCLE

REFLECTION DRIVE

12" DUCTILE IRON

14" ASBESTOS CONCRETE

2" PLASTIC

12" CPEP

EXISTING UTILITY LEGEND

W	WATER	U.E.	ELECTRIC PEDESTAL
S	SEWER	EM	ELECTRIC METER
G	NATURAL GAS	U.T.	TELEPHONE PEDESTAL
FO	FIBER OPTIC	U.C.	CABLE TV PEDESTAL
E	ELECTRIC		JUNCTION BOX TYPE 1 (LIGHTING/TRAFFIC)
T	TELEPHONE	FO	FIBER OPTIC VAULT
C	CABLE TELEVISION		STORM DRAIN CATCH BASIN
SD	STORM DRAIN		STORM DRAIN MANHOLE
FS	STORM FOOTING DRAIN	G.M.	GAS METER
SB	SUBDRAIN		UTILITY POLE
			LOAD CENTER

	LIGHT POLE
	GUY WIRE
	KEY BOX
	WATER VALVE
	FIRE HYDRANT
	SANITARY SEWER SERVICE
C.O.	SANITARY SEWER MANHOLE
C.O.	SANITARY SEWER CLEANOUT
FS	FOOTING DRAIN SERVICE
XX	PARCEL NUMBER

30 0 15 30 60
GRAPHIC SCALE

PROJECT: 10133.00
STATUS: DRAFT DSR

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PHONE: (907) 562-3252
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MUNICIPALITY OF ANCHORAGE

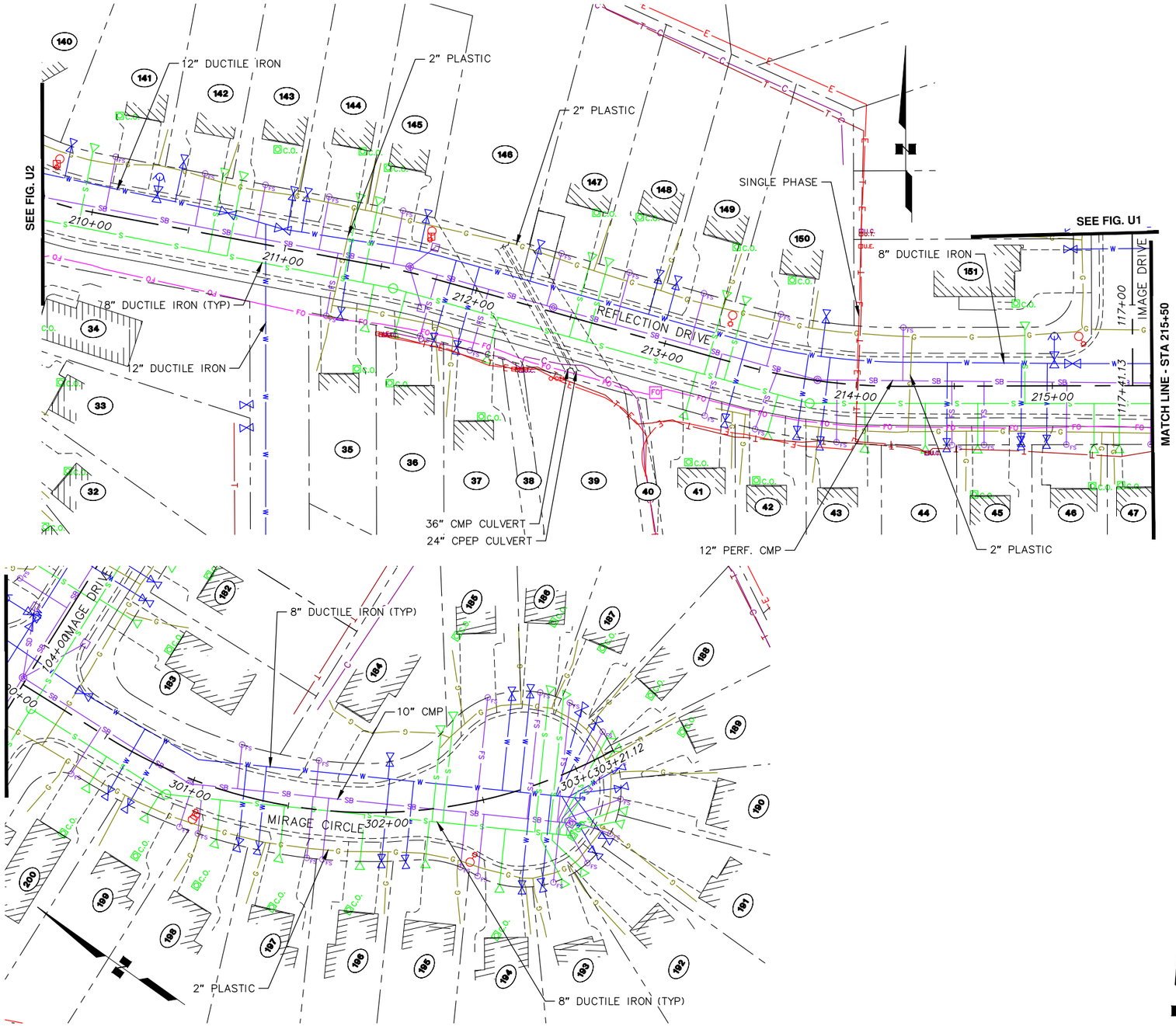
IMAGE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION
PM&E PROJECT NO. 14-50

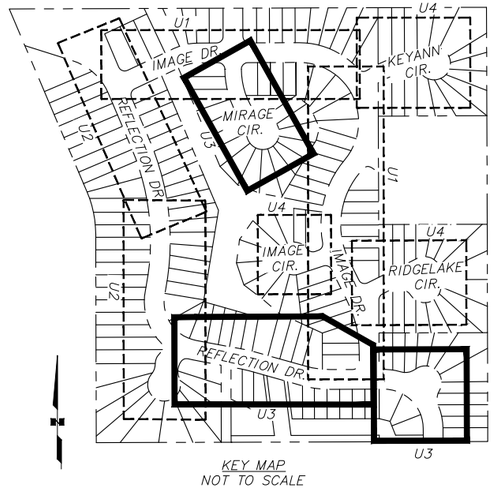
EXISTING UTILITIES

REFLECTION DRIVE/LOON COVE CIRCLE

DATE: DEC 2017
SCALE: GRAPHIC
FIGURE: U2

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\10133.00 Existing Utilities.dwg





KEY MAP
NOT TO SCALE

EXISTING UTILITY LEGEND

W — WATER	U.E. ELECTRIC PEDESTAL	LIGHT POLE
S — SEWER	EM ELECTRIC METER	GUY WIRE
G — NATURAL GAS	U.T. TELEPHONE PEDESTAL	KEY BOX
FO — FIBER OPTIC	U.C. CABLE TV PEDESTAL	WATER VALVE
E — ELECTRIC	JUNCTION BOX TYPE 1 (LIGHTING/TRAFFIC)	FIRE HYDRANT
T — TELEPHONE	FO FIBER OPTIC VAULT	SANITARY SEWER SERVICE
C — CABLE TELEVISION	STORM DRAIN CATCH BASIN	SANITARY SEWER MANHOLE
SD — STORM DRAIN	STORM DRAIN MANHOLE	C.O. SANITARY SEWER CLEANOUT
FS — STORM FOOTING DRAIN	G.M. GAS METER	FS FOOTING DRAIN SERVICE
SB — SUBDRAIN	UTILITY POLE	XX PARCEL NUMBER
	LOAD CENTER	

30 0 15 30 60
GRAPHIC SCALE

PROJECT: 10133.00
STATUS: DRAFT DSR

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PHONE: (907) 562-3252
#AECL882-AK

MUNICIPALITY OF ANCHORAGE

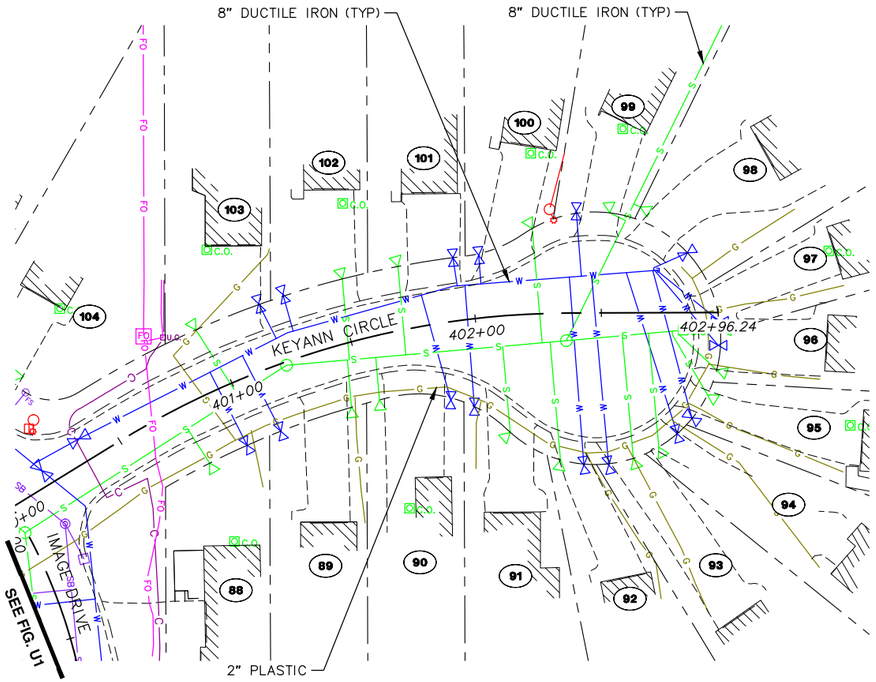
IMAGE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION
PM&E PROJECT NO. 14-50

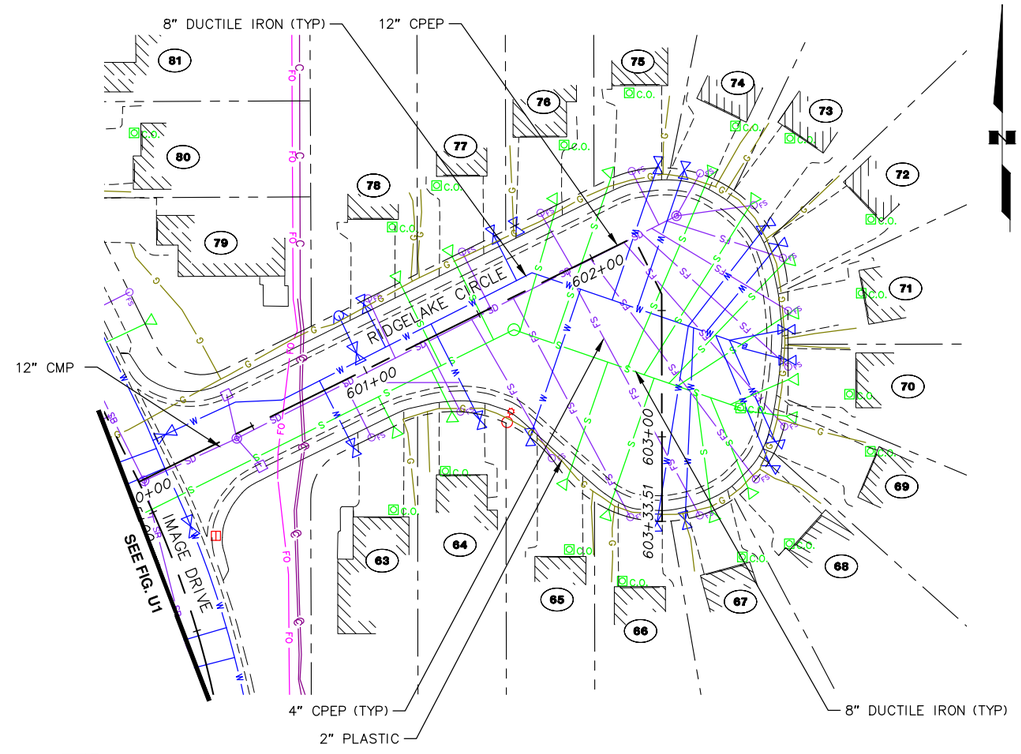
EXISTING UTILITIES

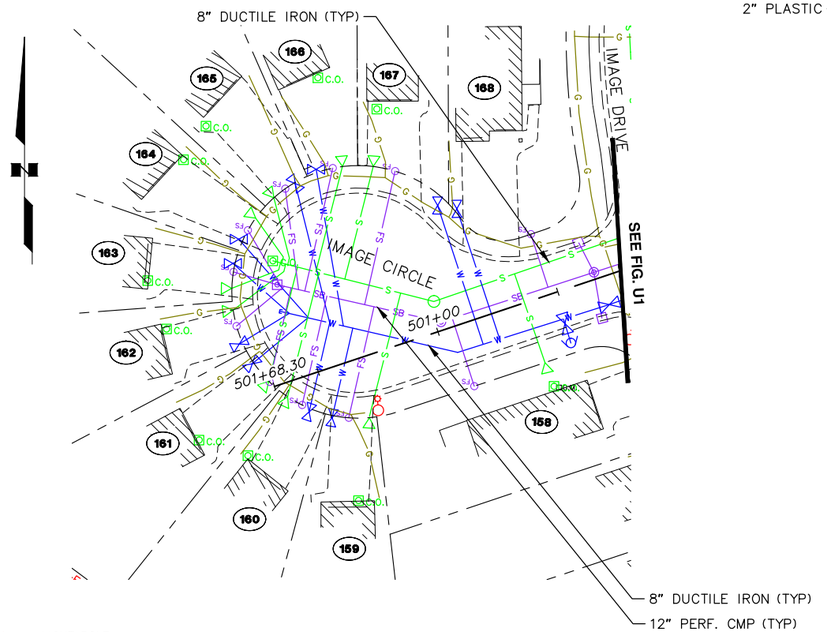
REFLECTION DR./MIRAGE CIRC./IMAGE CIRC./DEFIANCE ST.

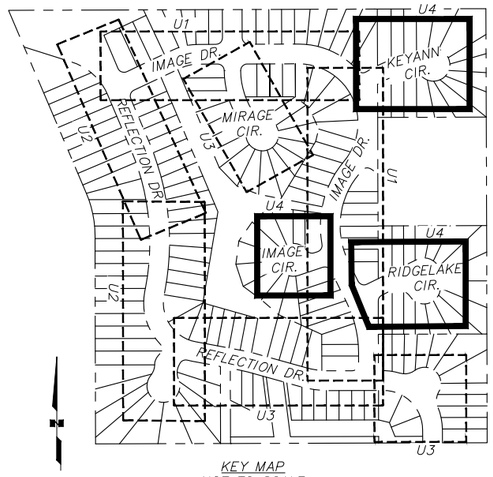
DATE: DEC 2017
SCALE: GRAPHIC
FIGURE: U3

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\10133.00 Existing Utilities.dwg









KEY MAP
NOT TO SCALE

EXISTING UTILITY LEGEND

W	WATER
S	SEWER
G	NATURAL GAS
FO	FIBER OPTIC
E	ELECTRIC
T	TELEPHONE
C	CABLE TELEVISION
SD	STORM DRAIN
FS	STORM FOOTING DRAIN
SB	SUBDRAIN

U.E.	ELECTRIC PEDESTAL
EM	ELECTRIC METER
U.T.	TELEPHONE PEDESTAL
U.C.	CABLE TV PEDESTAL
	JUNCTION BOX TYPE 1 (LIGHTING/TRAFFIC)
F.O.	FIBER OPTIC VAULT
	STORM DRAIN CATCH BASIN
	STORM DRAIN MANHOLE
G.M.	GAS METER
	UTILITY POLE
	LOAD CENTER

	LIGHT POLE
	GUY WIRE
	KEY BOX
	WATER VALVE
	FIRE HYDRANT
	SANITARY SEWER SERVICE
	SANITARY SEWER MANHOLE
c.o.	SANITARY SEWER CLEANOUT
FS	FOOTING DRAIN SERVICE
XX	PARCEL NUMBER

30 0 15 30 60
GRAPHIC SCALE

PROJECT: 10133.00
STATUS: DRAFT DSR

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

MUNICIPALITY OF ANCHORAGE

IMAGE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION
PM&E PROJECT NO. 14-50

EXISTING UTILITIES

KEYANN CIRCLE/RIDGELAKE CIRCLE

DATE: DEC 2017
SCALE: GRAPHIC
FIGURE: U4

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\10133.00 Existing Utilities.dwg

Traffic Data and Reports

Appendix E

Image Drive/Reflection Drive Area Road Reconstruction
Speed and Volume Summary

Location: **Image Drive, 190' east of Reflection Drive (north side)**

Date	Day of Week	Daily Volume (veh/day)	85th Percentile speed (mph)	Percent of AADT for day/week[1]	AADT
7/22/2014	Tuesday	486	20	1.125	432
7/23/2014	Wednesday	519	19	1.130	459
		average =	19.5		446

Location: **Image Drive, 130' north of Image Circle**

Date	Day of Week	Daily Volume (veh/day)	85th Percentile speed (mph)	Percent of AADT for day/week[1]	AADT
7/22/2014	Tuesday	420	21	1.125	373
7/23/2014	Wednesday	442	21	1.130	391
		average =	21		382

Location: **Reflection Drive, 480' south of Image Drive (north side)**

Date	Day of Week	Daily Volume (veh/day)	85th Percentile speed (mph)	Percent of AADT for day/week[1]	AADT
8/31/2016	Wednesday	499	23	1.086	459
9/1/2016	Thursday	485	23	1.098	442
		average =	23		451

Location: **Reflection Drive, 245' west of Image Drive (south side)**

Date	Day of Week	Daily Volume (veh/day)	85th Percentile speed (mph)	Percent of AADT for day/week[1]	AADT
8/31/2016	Wednesday	486	23	1.086	448
9/1/2016	Thursday	496	23	1.098	452
		average =	23		450

Location: **Image Drive, 100' south of Keyann Circle**

Date	Day of Week	Daily Volume (veh/day)	85th Percentile speed (mph)	Percent of AADT for day/week[1]	AADT
8/31/2016	Wednesday	390	20	1.086	359
9/1/2016	Thursday	381	20	1.098	347
		average =	20		353

1. From nearest permanent traffic recorder at Tudor Road, west of Tudor Center Drive.

Image Drive/Reflection Drive Area Road Reconstruction
Speed and Volume Summary

Roadway	AADT	85th Percentile speed (mph)
Image Drive	394	20
Reflection Drive	450	23
	416	21.3


AADT: 445
85th: 20 mph
Image Drive
Keyann Cir.
Reflection Drive
Mirage Cir
AADT: 353
85th: 20 mph
AADT: 451
85th: 23 mph
AADT: 382
85th: 21 mph
Image Cir.
Ridgelake Cir
Image Drive
Boniface Parkway
Loon Cove Cir.
Reflection Drive
AADT: 450
85th: 23 mph
Defiance St.

TUDOR ROAD - WEST OF TUDOR CENTER DRIVE - TOTAL

ROUTE: 133899 **MILEPOINT: 4.396** **STATION NUMBER: 10125449 0** **PERMANENT STN SUMMARY: 2013**

MNTH	MADT	% AADT	6AM - 10PM	10PM - 6AM	PERCENT OF AADT FOR DAY OF WEEK MON	TUE	WED	THU	FRI	WKDY	SAT	SUN
JAN	28303	93.7	89.4	10.6	102.6	102.7	111.4	111.7	115.4	108.8	86.7	69.5
FEB	29839	98.8	89.7	10.3	103.1	107.9	108.1	110.3	111.7	108.2	88.2	70.6
MAR	30260	100.2	89.6	10.4	101.2	107.2	109.2	108.7	112.1	107.7	88.6	73.0
APR	31192	103.3	90.2	9.8	104.0	105.9	108.8	108.0	114.7	108.3	87.2	71.4
MAY	31280	103.6	89.7	10.3	97.0	108.1	110.5	110.2	114.0	108.0	84.1	76.1
JUN	32254	106.8	88.7	11.3	106.0	107.8	108.2	109.6	110.7	108.5	84.9	72.9
JUL	30516	101.0	88.5	11.5	110.1	112.5	113.0	100.7	108.5	109.0	81.5	73.6
AUG	31736	105.1	89.5	10.5	105.5	106.6	108.6	109.0	111.3	108.2	82.9	76.1
SEP	30880	102.2	90.5	9.5	99.5	108.8	109.2	109.8	113.2	108.1	87.6	71.9
OCT	31202	103.3	90.5	9.5	103.5	106.5	108.5	108.3	113.1	108.0	89.4	70.7
NOV	27870	92.3	90.0	10.0	108.2	112.6	112.8	101.2	108.9	108.7	86.4	70.0
DEC	27106	89.7	88.6	11.4	109.9	108.7	100.5	105.0	114.2	107.7	88.5	73.2
AADT	30203		89.6	10.4	104.2	107.9	109.1	107.7	112.3	108.3	86.3	72.4

HISTORY YEAR	AADT	PERCENT GROWTH
2013	30203	-3.1
2012	31155	-2.5
2011	31949	-15.6
2010	37832	-9.9
2009	41999	0.9
2008	41614	2.4
2007	40645	-0.5
2006	40847	2.9
2005	39690	-6.2
2004	42299	-1.1
2003	42775	1.8
2002	42026	0.0
2001	42046	0.1
2000	41985	0.7
1999	41688	1.0
1998	41279	-2.7
1997	42435	1.6
1996	41785	1.2
1995	41306	-0.6
1994	41546	2.2
1993	40638	3.1
1992	39416	11.0
1991	35503	-0.4
1990	35638	4.5
1989	34102	

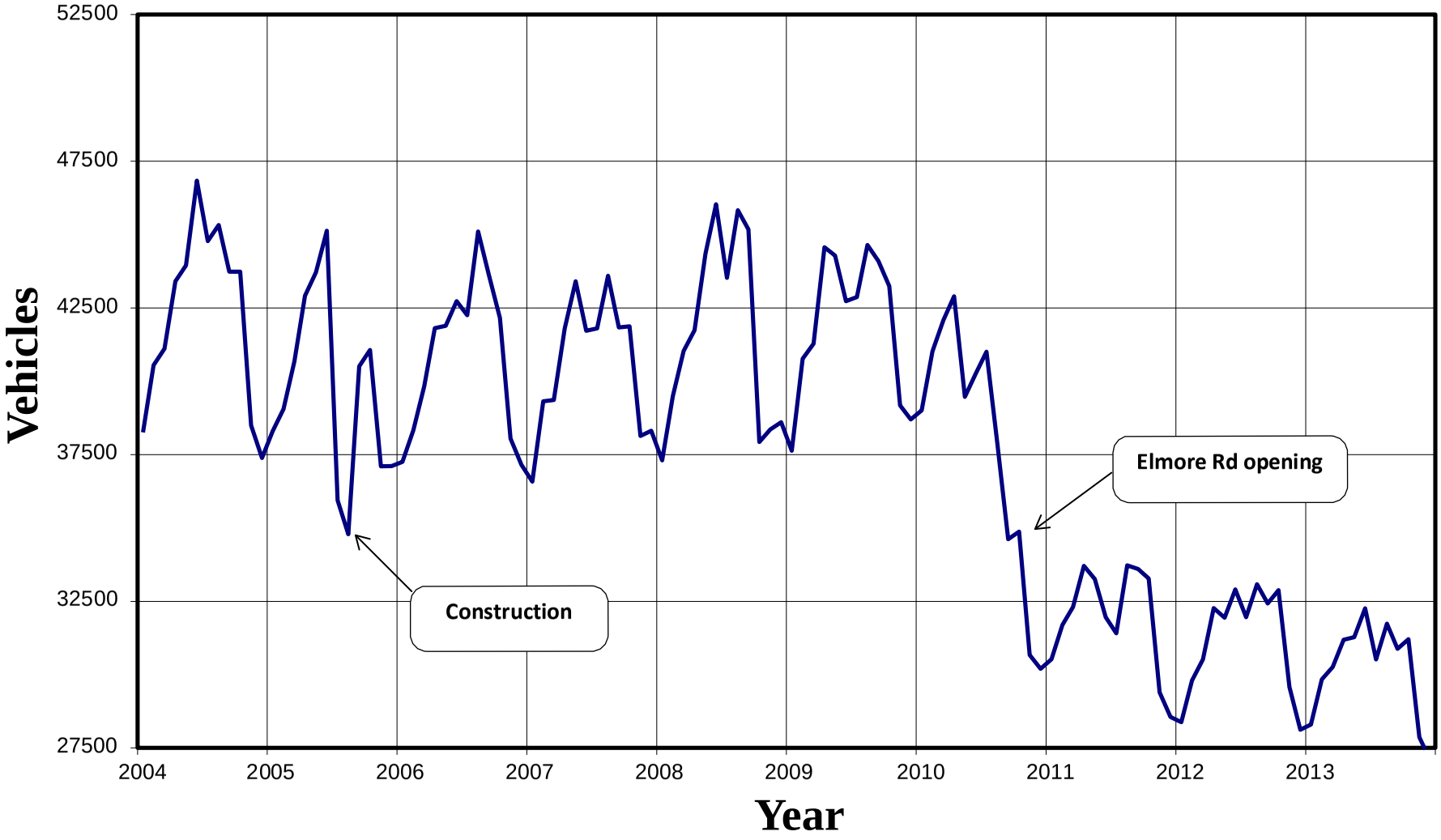
HIGH DAYS	1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	AVG
VOLUME	37193	36661	36471	36451	36392	36310	36155	35955	35922	35847	36336
DAY	05/31	06/14	04/26	05/10	10/04	04/19	07/12	08/23	08/30	06/07	
% AADT	123.1	121.4	120.8	120.7	120.5	120.2	119.7	119.0	118.9	118.7	120.3

HIGH HOURS	1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	20TH	30TH	40TH	50TH	AVG
VOLUME	3003	2967	2958	2941	2938	2938	2930	2917	2907	2906	2895	2867	2851	2834	2941
HOUR	6PM	6PM	6PM	6PM	6PM	5PM	6PM	6PM	6PM	5PM	6PM	6PM	6PM	6PM	
DAY	04/04	03/19	07/16	10/23	07/10	04/26	06/11	04/17	06/05	10/04	01/11	06/06	04/15	04/05	
% AADT	9.9	9.8	9.8	9.7	9.7	9.7	9.7	9.7	9.6	9.6	9.6	9.5	9.4	9.4	9.7

PERCENT OF AADT BY HOUR

1AM	2AM	3AM	4AM	5AM	6AM	7AM	8AM	9AM	10AM	11AM	12PM	1PM	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM	11PM	12AM
1.3	0.9	0.6	0.5	0.7	1.5	3.2	5.5	5.4	4.9	4.7	5.5	6.3	6.2	6.3	6.9	7.7	7.9	6.4	4.9	4.2	3.6	2.8	2.0

Tudor Road – West of Tudor Center Drive
Monthly Average Daily Traffic



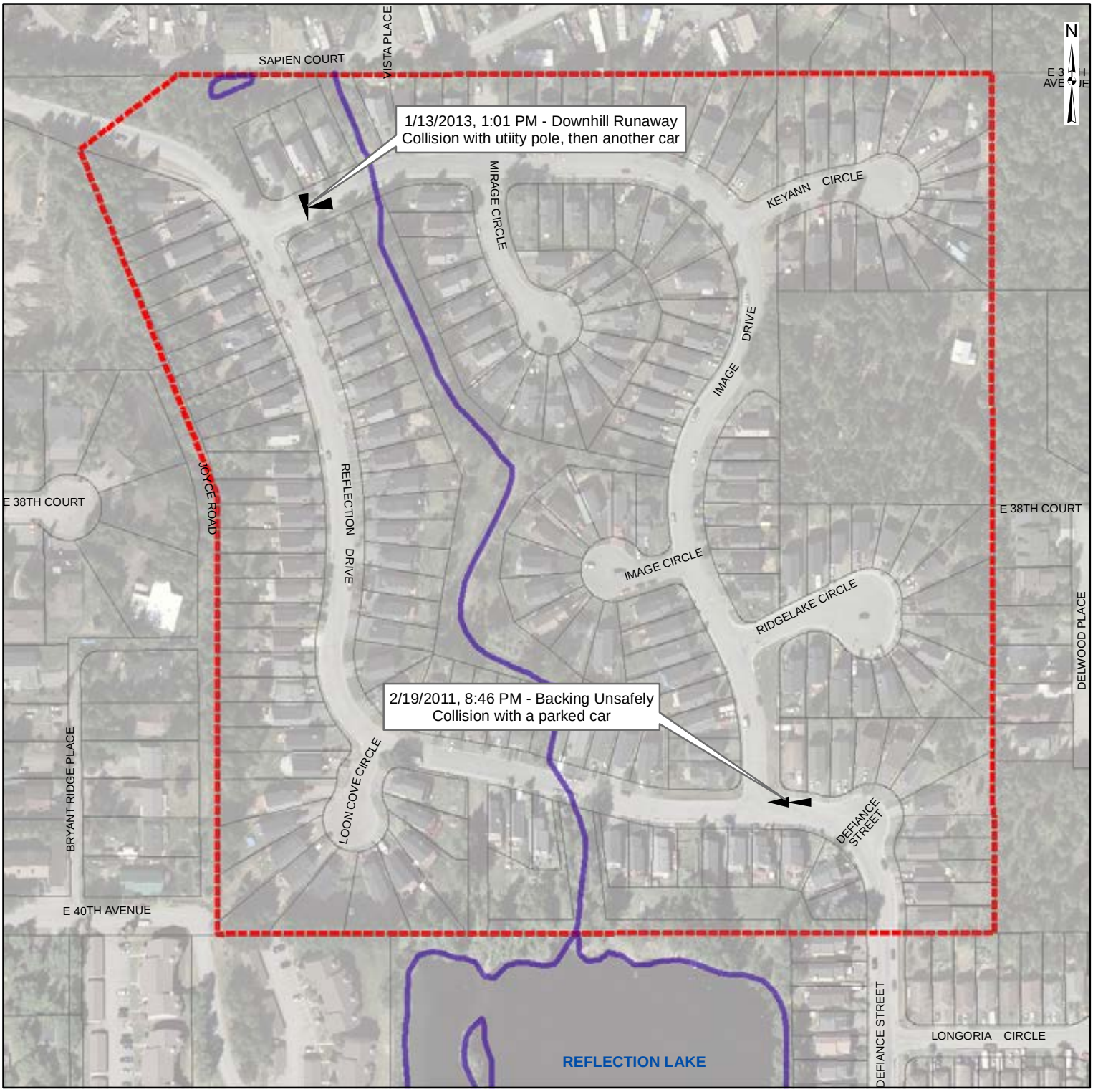
Collision Events

Location: **Street: REFLECTION DRIVE, ANCHORAGE from IMAGE DRIVE, ANCHORAGE (N.W. SIDE) to IMAGE DRIVE, ANCHORAGE**

Date	Time	Dist	Dir	Street	Cross Reference	1st Harmful Event Loc	Most Harmful Event	Impact	Unit No.	Most Cont	Unit Event	Vehicle Action	Human Circum 1	Human Circum 2	Int Related
1/13/2013	PM 01:01	0 ft.	None	REFLECTION DRIVE	IMAGE DRIVE, ANCHORAGE (N.W. SIDE)	Roadside	Utility Pole/Light Support	Not a Collision with a Motor Vehicle In-Transport	1	Yes	Downhill Runaway Other	Straight ahead	Unsafe speed	Swerve to Avoid Object	Related
1/13/2013	PM 01:01	100 ft.	East	REFLECTION DRIVE	IMAGE DRIVE, ANCHORAGE (N.W. SIDE)	Roadway	Motor Vehicle In-Transport	Sideswipe - Opposite Direction	1	Yes	Downhill Runaway Other	Straight ahead	Unsafe speed	Unk	Related
1/13/2013	PM 01:01	100 ft.	East	REFLECTION DRIVE	IMAGE DRIVE, ANCHORAGE (N.W. SIDE)	Roadway	Motor Vehicle In-Transport	Sideswipe - Opposite Direction	2	No	Motor Vehicle In-Transport Other	Stopped	No improper driving	Unk	Related

Location: **Street: IMAGE DRIVE, ANCHORAGE REFLECTION DRIVE, ANCHORAGE (S.E. SIDE)**

Date	Time	Dist	Dir	Street	Cross Reference	1st Harmful Event Loc	Most Harmful Event	Impact	Unit No.	Most Cont	Unit Event	Vehicle Action	Human Circum 1	Human Circum 2	Int Related
1/15/2009	AM 02:43	75 ft.	E	DEFIANCE STREET,	IMAGE DRIVE, ANCHORAGE	Roadside	Mail box		1			Skidding	Unsafe speed		Not Related
2/19/2011	PM 08:46	250 ft.	E	REFLECTION DRIVE(S.E. SIDE)	IMAGE DRIVE, ANCHORAGE	Roadside	Parked vehicle		1			Backing	Backing unsafely		Not Related
2/19/2011	PM 08:46	250 ft.	E	REFLECTION DRIVE (S.E.	IMAGE DRIVE, ANCHORAGE	Roadside	Parked vehicle		2			Parked	Unk		Not Related



Legend

- Project Boundary
- Angle Collision
- Rear-end Collision

Collision Diagram

Image/Reflection Drive Area Reconstruction

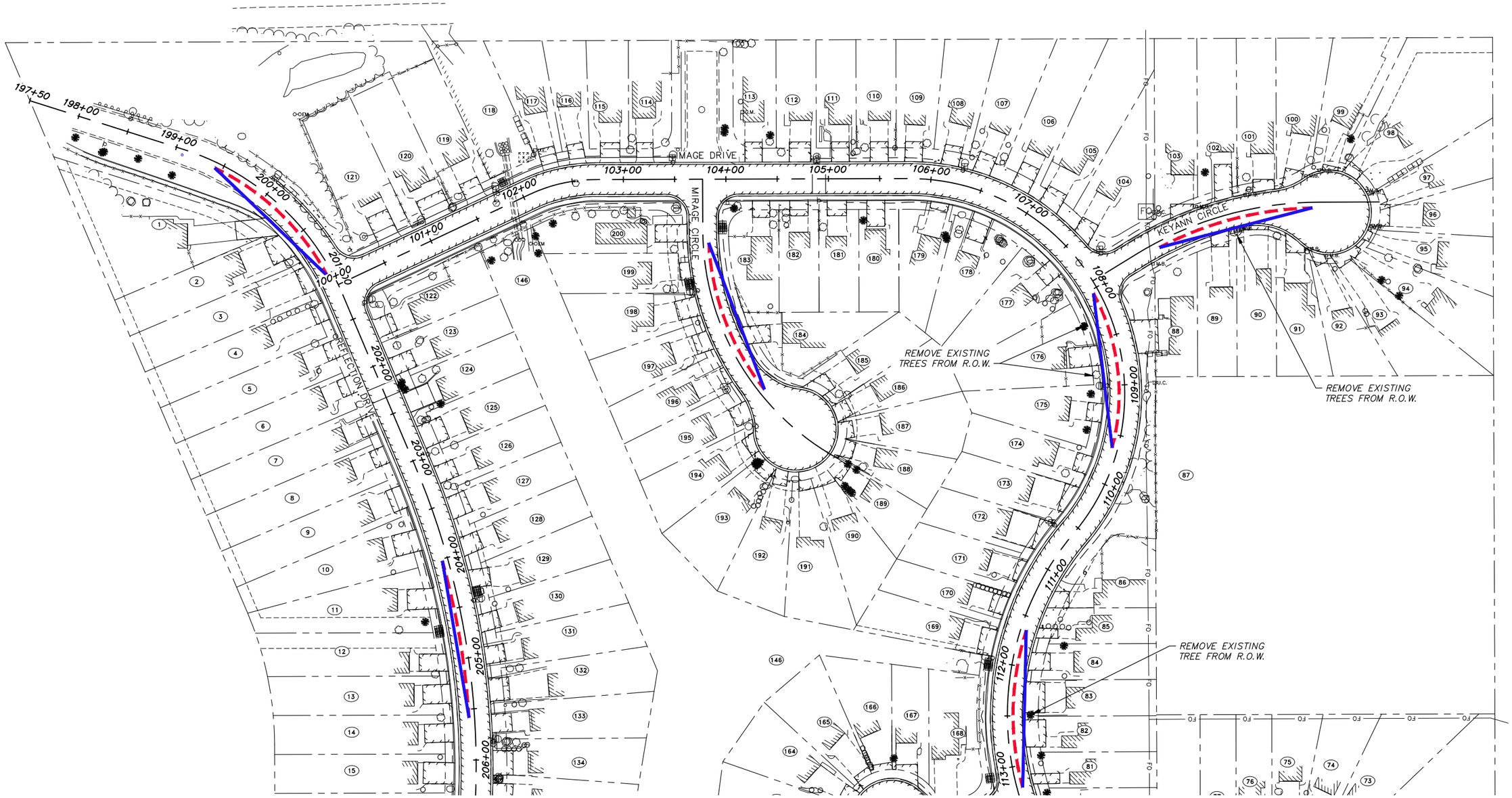
CRW ENGINEERING GROUP, LLC

Figure: 1

Date: Dec 2017

Departure Sight Triangles & Stopping Sight Distance Drawings

Appendix F



LEGEND

STOPPING SIGHT DISTANCE

LINE OF SIGHT

NOTE:

STOPPING SIGHT DISTANCES SHOWN ARE NOT ALL INCLUSIVE. ONLY STOPPING SIGHT DISTANCES AT WORST CASE LOCATIONS ARE SHOWN.

50' 0 50' 100'

PROJECT: 10133.00

STATUS: DSR

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MUNICIPALITY OF ANCHORAGE

IMAGE DRIVE/REFLECTION DRIVE AREA
ROAD RECONSTRUCTION

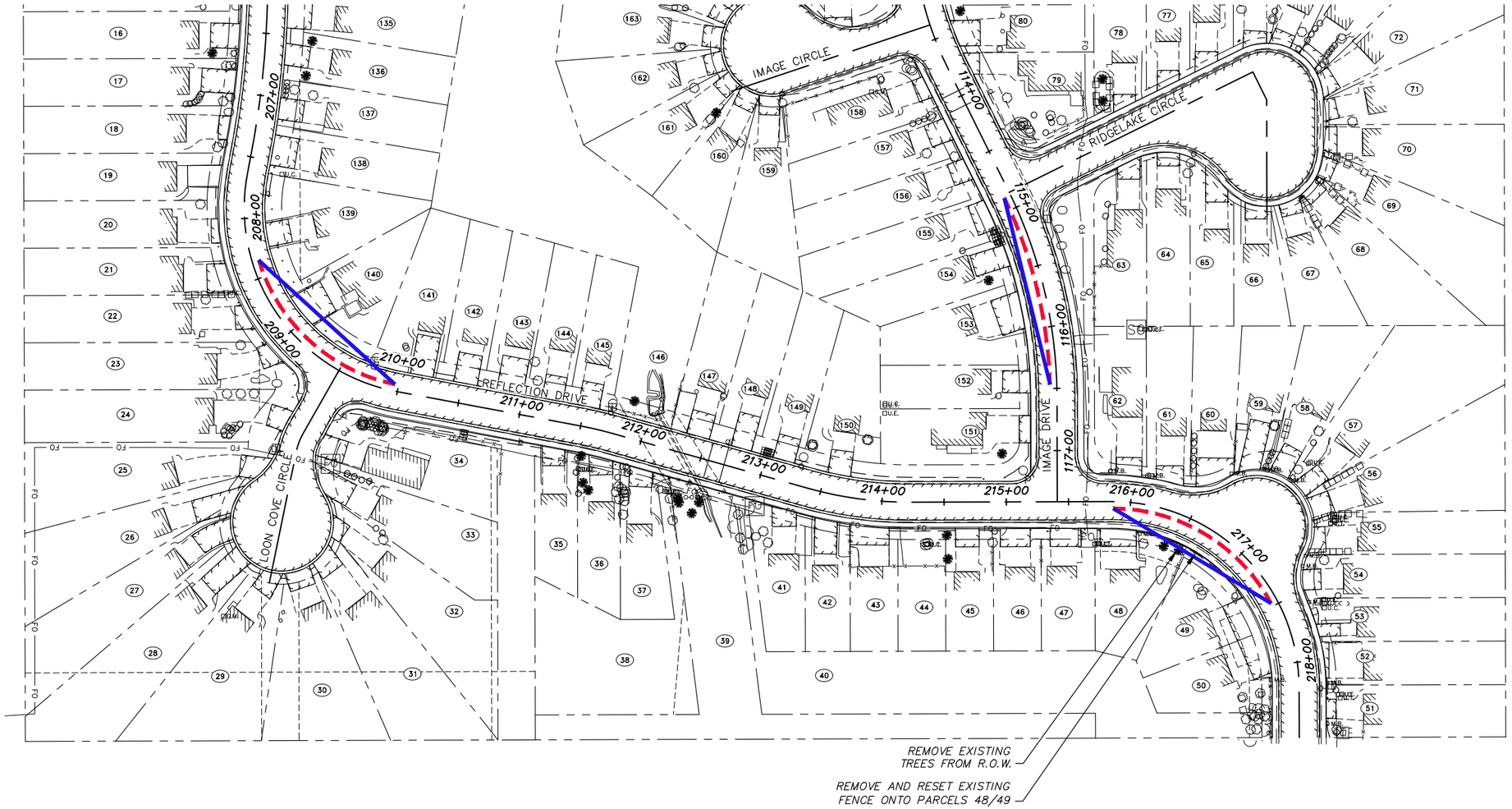
STOPPING SIGHT DISTANCE ALONG HORIZONTAL CURVE

DATE: DEC 2017

SCALE: GRAPHIC

FIGURE: 1 OF 2

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Horizontal SSD.dwg



LEGEND

STOPPING SIGHT DISTANCE

LINE OF SIGHT

NOTE:

STOPPING SIGHT DISTANCES SHOWN ARE NOT ALL INCLUSIVE. ONLY STOPPING SIGHT DISTANCES AT WORST CASE LOCATIONS ARE SHOWN.

50' 0 50' 100'

PROJECT: 10133.00

STATUS: DSR

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

MUNICIPALITY OF ANCHORAGE

IMAGE DRIVE/REFLECTION DRIVE AREA
ROAD RECONSTRUCTION

STOPPING SIGHT DISTANCE ALONG HORIZONTAL CURVE

DATE: DEC 2017

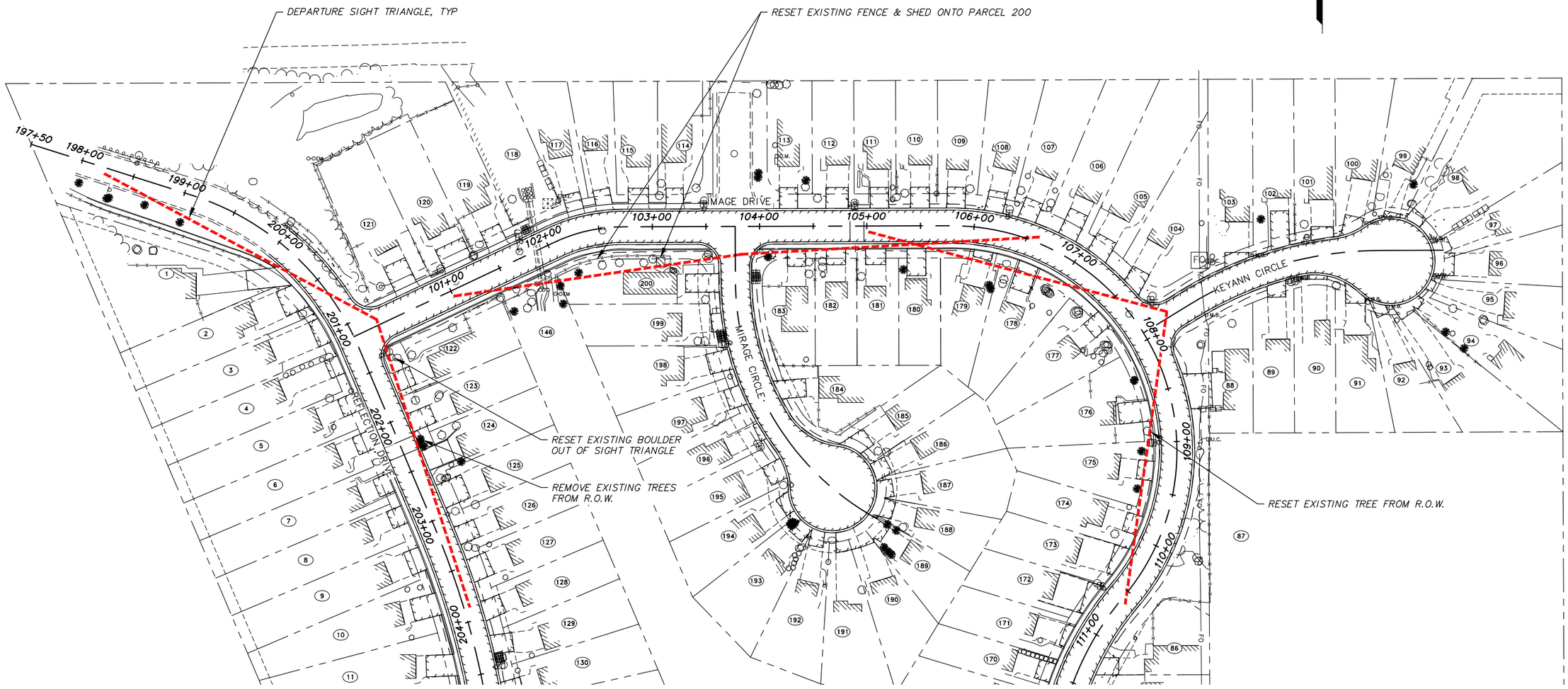
SCALE: GRAPHIC

FIGURE: 2 OF 2

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Horizontal SSD.dwg

NOTE:

DECISION POINT FOR EACH INTERSECTION IS SETBACK 15'-18' FROM EDGE OF TRAVELED WAY PER FIGURE 1-19 OF THE MOA DESIGN CRITERIA MANUAL



50' 0 50' 100'

PROJECT: 10133.00

STATUS: DSR

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MUNICIPALITY OF ANCHORAGE

IMAGE DRIVE/REFLECTION DRIVE AREA
ROAD RECONSTRUCTION

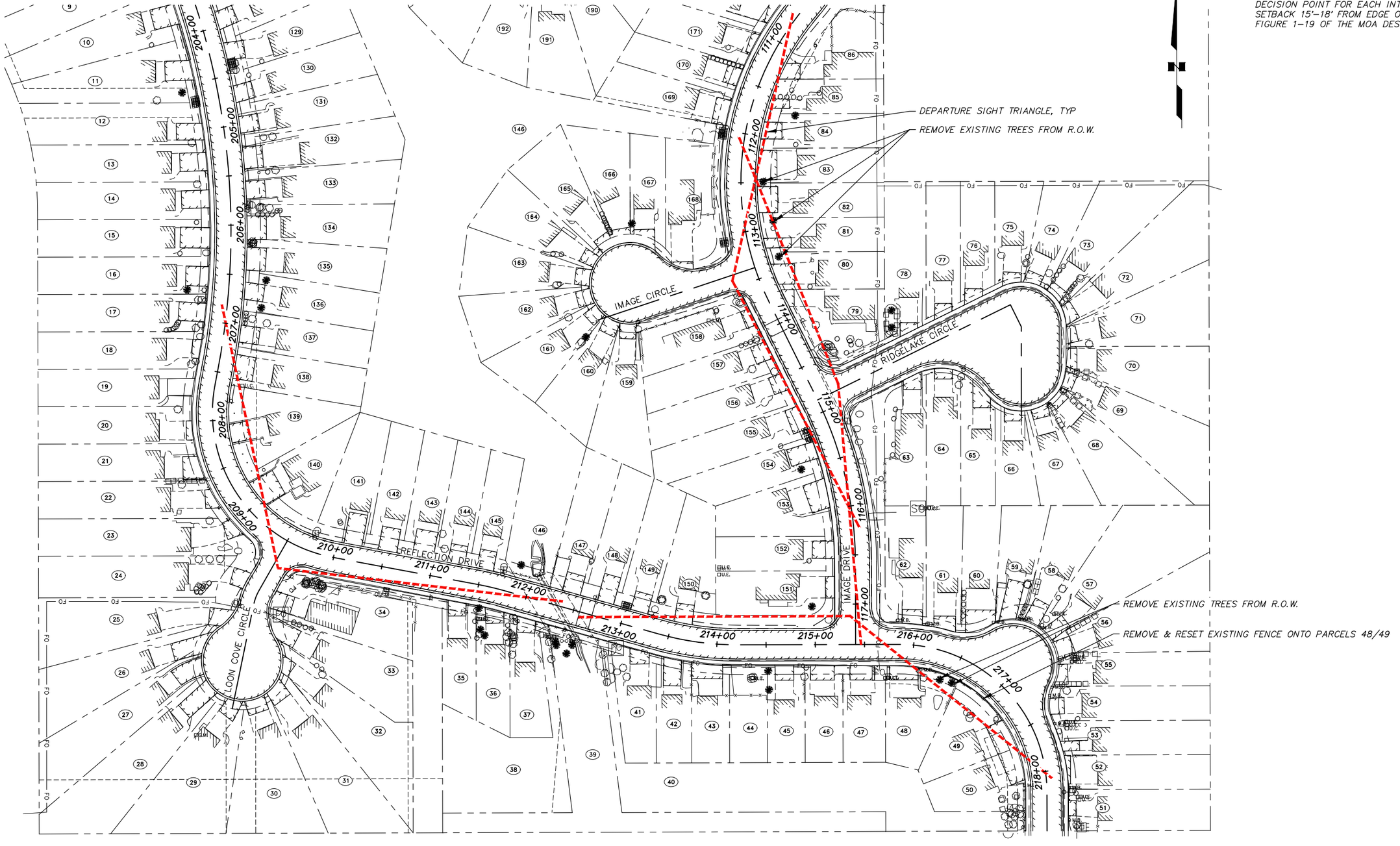
INTERSECTION DEPARTURE SIGHT TRIANGLES

DATE: DEC 2017

SCALE: GRAPHIC

FIGURE: 1 OF 2

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Departure Sight Triangles.dwg



NOTE:

DECISION POINT FOR EACH INTERSECTION IS SETBACK 15'–18' FROM EDGE OF TRAVELED WAY PER FIGURE 1–19 OF THE MOA DESIGN CRITERIA MANUAL

50' 0 50' 100'

PROJECT: 10133.00

STATUS: DSR

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MUNICIPALITY OF ANCHORAGE

IMAGE DRIVE/REFLECTION DRIVE AREA
ROAD RECONSTRUCTION

INTERSECTION DEPARTURE SIGHT TRIANGLES

DATE: DEC 2017

SCALE: GRAPHIC

FIGURE: 2 OF 2

File: J:\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\01 Working Set\01 Civil\10133.00 Departure Sight Triangles.dwg

Summary of Driveway Grades

Appendix G

DRIVEWAY SUMMARY

SHEET	PARCEL	CENTERLINE REFERENCE		EXISTING GRADE	PROPOSED GRADE	SURFACE TYPE ON PROPERTY	REMARKS
		STATION	OFFSET				
R1	121	100+63	LT	5.4%	6.7%	ASPHALT	IMAGE DRIVE
R1	120	101+17	LT	3.0%	5.7%	ASPHALT	IMAGE DRIVE
R1	119	101+58	LT	4.5%	6.5%	ASPHALT	IMAGE DRIVE
R1	117	102+33	LT	3.2%	4.7%	ASPHALT	IMAGE DRIVE
R1	116	102+60	LT	3.8%	5.7%	ASPHALT	IMAGE DRIVE
R1	115	102+87	LT	5.2%	6.3%	ASPHALT	IMAGE DRIVE
R1	114	103+21	LT	3.4%	4.4%	ASPHALT	IMAGE DRIVE
R1	113	104+27	LT	5.4%	3.4%	ASPHALT	IMAGE DRIVE
R1	183	104+34	RT	6.9%	4.3%	ASPHALT	IMAGE DRIVE
R1	182	104+71	RT	7.3%	5.1%	ASPHALT	IMAGE DRIVE
R1	112	104+72	LT	5.5%	3.2%	ASPHALT	IMAGE DRIVE
R1	181	105+08	RT	5.2%	6.8%	ASPHALT	IMAGE DRIVE
R1	111	105+12	LT	5.6%	6.2%	ASPHALT	IMAGE DRIVE
R1	180	105+46	RT	7.2%	9.8%	ASPHALT	IMAGE DRIVE
R1	110	105+50	LT	4.3%	6.2%	ASPHALT	IMAGE DRIVE
R1	109	105+82	LT	6.2%	7.6%	ASPHALT	IMAGE DRIVE
R2	108	106+14	LT	6.6%	4.7%	ASPHALT	IMAGE DRIVE
R2	179	106+15	RT	8.9%	6.8%	ASPHALT	IMAGE DRIVE
R2	107	106+44	LT	6.4%	3.4%	ASPHALT	IMAGE DRIVE
R2	178	106+60	RT	6.8%	3.3%	ASPHALT	IMAGE DRIVE
R2	106	106+84	LT	11.6%	6.8%	ASPHALT	IMAGE DRIVE
R2	105	107+16	LT	9.3%	4.4%	ASPHALT	IMAGE DRIVE
R2	177	107+59	RT	10.2%	8.0%	ASPHALT	IMAGE DRIVE
R2	104	107+60	LT	7.3%	4.8%	ASPHALT	IMAGE DRIVE
R2	88	108+53	LT	4.8%	5.9%	ASPHALT	IMAGE DRIVE
R2	176	108+69	RT	8.6%	9.6%	ASPHALT	IMAGE DRIVE
R2	175	109+30	RT	9.4%	9.8%	ASPHALT	IMAGE DRIVE
R2	174	109+87	RT	8.0%	8.4%	ASPHALT	IMAGE DRIVE
R2	173	110+24	RT	6.1%	5.4%	ASPHALT	IMAGE DRIVE
R2	172	110+68	RT	5.8%	5.5%	ASPHALT	IMAGE DRIVE
R3	171	111+10	RT	10.7%	6.3%	ASPHALT	IMAGE DRIVE
R3	86	111+33	LT	6.8%	2.5%	ASPHALT	IMAGE DRIVE
R3	170	111+47	RT	10.4%	8.4%	ASPHALT	IMAGE DRIVE
R3	85	111+68	LT	5.2%	5.4%	ASPHALT	IMAGE DRIVE
R3	169	111+83	RT	8.9%	9.0%	ASPHALT	IMAGE DRIVE
R3	84	111+96	LT	5.3%	6.4%	ASPHALT	IMAGE DRIVE
R3	83	112+32	LT	8.3%	6.9%	ASPHALT	IMAGE DRIVE
R3	82	112+75	LT	6.9%	7.9%	ASPHALT	IMAGE DRIVE
R3	81	113+12	LT	8.0%	8.0%	ASPHALT	IMAGE DRIVE

DRIVEWAY SUMMARY

SHEET	PARCEL	CENTERLINE REFERENCE		EXISTING GRADE	PROPOSED GRADE	SURFACE TYPE ON PROPERTY	REMARKS
		STATION	OFFSET				
R3	80	113+45	LT	8.0%	6.4%	ASPHALT	IMAGE DRIVE
R3	79	113+72	LT	4.5%	6.2%	ASPHALT	IMAGE DRIVE
R3	158	113+84	RT	8.3%	8.9%	ASPHALT	IMAGE DRIVE
R3	157	114+21	RT	8.4%	9.8%	ASPHALT	IMAGE DRIVE
R3	156	114+58	RT	5.8%	7.2%	ASPHALT	IMAGE DRIVE
R3	155	114+98	RT	8.1%	8.7%	ASPHALT	IMAGE DRIVE
R3	154	115+35	RT	8.4%	10.0%	ASPHALT	IMAGE DRIVE
R3	153	115+79	RT	5.8%	6.7%	ASPHALT	IMAGE DRIVE
R3	152	116+45	RT	13.4%	13.2%	ASPHALT	IMAGE DRIVE
R3	151	116+83	RT	10.4%	8.8%	ASPHALT	IMAGE DRIVE
R4	1	200+42	RT	2.8%	3.1%	CONCRETE	REFLECTION DRIVE
R4	2	200+58	RT	8.2%	8.1%	ASPHALT	REFLECTION DRIVE
R4	3	200+97	RT	8.4%	8.6%	ASPHALT	REFLECTION DRIVE
R4	4	201+32	RT	9.5%	8.7%	ASPHALT	REFLECTION DRIVE
R4	122	201+68	LT	7.5%	4.6%	ASPHALT	REFLECTION DRIVE
R4	5	201+70	RT	9.6%	10.0%	ASPHALT	REFLECTION DRIVE
R4	123	202+08	LT	4.5%	1.2%	ASPHALT	REFLECTION DRIVE
R4	6	202+08	RT	10.7%	10.2%	ASPHALT	REFLECTION DRIVE
R4	124	202+46	LT	3.6%	1.0%	CONCRETE	REFLECTION DRIVE
R4	7	202+52	RT	10.8%	7.5%	ASPHALT	REFLECTION DRIVE
R4	125	202+82	LT	4.5%	1.7%	ASPHALT	REFLECTION DRIVE
R4	8	202+84	RT	10.6%	7.1%	ASPHALT	REFLECTION DRIVE
R4	126	203+22	LT	4.1%	2.3%	ASPHALT	REFLECTION DRIVE
R4	9	203+29	RT	12.9%	12.1%	ASPHALT	REFLECTION DRIVE
R4	127	203+57	LT	4.0%	3.6%	ASPHALT	REFLECTION DRIVE
R4	10	203+77	RT	11.7%	11.7%	ASPHALT	REFLECTION DRIVE
R4	128	203+97	LT	4.4%	5.9%	ASPHALT	REFLECTION DRIVE
R4	129	204+24	LT	3.7%	6.0%	ASPHALT	REFLECTION DRIVE
R4	11	204+40	RT	10.4%	10.4%	ASPHALT	REFLECTION DRIVE
R5	130	204+71	LT	5.0%	6.5%	ASPHALT	REFLECTION DRIVE
R5	131	205+01	LT	7.0%	7.9%	ASPHALT	REFLECTION DRIVE
R5	12	205+05	RT	11.3%	11.2%	ASPHALT	REFLECTION DRIVE
R5	132	205+33	LT	5.2%	4.7%	ASPHALT	REFLECTION DRIVE
R5	13	205+35	RT	10.4%	10.4%	ASPHALT	REFLECTION DRIVE
R5	133	205+66	LT	9.2%	9.8%	ASPHALT	REFLECTION DRIVE
R5	14	205+73	RT	9.4%	9.8%	ASPHALT	REFLECTION DRIVE
R5	134	206+03	LT	12.4%	11.7%	ASPHALT	REFLECTION DRIVE
R5	15	206+14	RT	13.6%	13.1%	ASPHALT	REFLECTION DRIVE
R5	135	206+33	LT	10.8%	10.3%	ASPHALT	REFLECTION DRIVE

DRIVEWAY SUMMARY

SHEET	PARCEL	CENTERLINE REFERENCE		EXISTING GRADE	PROPOSED GRADE	SURFACE TYPE ON PROPERTY	REMARKS
		STATION	OFFSET				
R5	16	206+53	RT	12.5%	12.0%	ASPHALT	REFLECTION DRIVE
R5	136	206+64	LT	8.9%	9.2%	ASPHALT	REFLECTION DRIVE
R5	17	206+91	RT	10.8%	10.3%	ASPHALT	REFLECTION DRIVE
R5	137	207+08	LT	7.7%	7.6%	ASPHALT	REFLECTION DRIVE
R5	18	207+28	RT	8.9%	8.6%	ASPHALT	REFLECTION DRIVE
R5	138	207+42	LT	7.6%	6.7%	ASPHALT	REFLECTION DRIVE
R5	19	207+65	RT	11.9%	10.6%	CONCRETE	REFLECTION DRIVE
R5	20	208+09	RT	13.6%	13.5%	ASPHALT	REFLECTION DRIVE
R5	139	208+17	LT	9.2%	6.5%	ASPHALT	REFLECTION DRIVE
R5	21	208+49	RT	9.7%	6.9%	ASPHALT	REFLECTION DRIVE
R5	22	208+84	RT	12.8%	9.5%	ASPHALT	REFLECTION DRIVE
R5	140	208+89	LT	5.7%	4.1%	ASPHALT	REFLECTION DRIVE
R5	23	209+09	RT	13.6%	10.8%	ASPHALT	REFLECTION DRIVE
R6	141	210+17	LT	4.3%	5.7%	ASPHALT	REFLECTION DRIVE
R6	142	210+53	LT	5.3%	6.9%	ASPHALT	REFLECTION DRIVE
R6	143	210+89	LT	4.8%	6.9%	ASPHALT	REFLECTION DRIVE
R6	144	211+24	LT	4.9%	6.1%	ASPHALT	REFLECTION DRIVE
R6	35	211+28	RT	5.9%	7.4%	ASPHALT	REFLECTION DRIVE
R6	145	211+53	LT	2.8%	3.2%	ASPHALT	REFLECTION DRIVE
R6	36	211+66	RT	5.2%	6.2%	ASPHALT	REFLECTION DRIVE
R6	37	212+02	RT	6.9%	5.0%	ASPHALT	REFLECTION DRIVE
R6	147	212+43	LT	3.9%	1.0%	ASPHALT	REFLECTION DRIVE
R6	148	212+79	LT	1.3%	1.9%	ASPHALT	REFLECTION DRIVE
R6	149	213+15	LT	4.8%	4.8%	ASPHALT	REFLECTION DRIVE
R6	41	213+20	RT	4.6%	6.5%	ASPHALT	REFLECTION DRIVE
R6	42	213+55	RT	7.4%	7.4%	ASPHALT	REFLECTION DRIVE
R6	150	213+63	LT	7.6%	9.7%	ASPHALT	REFLECTION DRIVE
R6	43	213+90	RT	7.7%	8.2%	ASPHALT	REFLECTION DRIVE
R6	45	214+69	RT	7.0%	6.5%	ASPHALT	REFLECTION DRIVE
R6	46	215+07	RT	5.4%	5.7%	ASPHALT	REFLECTION DRIVE
R6	47	215+48	RT	11.2%	8.4%	ASPHALT	REFLECTION DRIVE
R7	48	215+90	RT	10.8%	9.7%	ASPHALT	REFLECTION DRIVE
R7	62	215+98	LT	4.0%	4.4%	ASPHALT	REFLECTION DRIVE
R7	61	216+32	LT	3.7%	5.4%	ASPHALT	REFLECTION DRIVE
R7	60	216+72	LT	2.5%	4.5%	ASPHALT	REFLECTION DRIVE
R7	56	216+84	LT	8.2%	9.4%	ASPHALT	REFLECTION DRIVE
R7	57	216+87	LT	0.5%	2.4%	ASPHALT	REFLECTION DRIVE
R7	55	216+89	LT	12.3%	11.0%	ASPHALT	REFLECTION DRIVE
R7	59	216+89	LT	-1.1%	1.1%	ASPHALT	REFLECTION DRIVE

DRIVEWAY SUMMARY

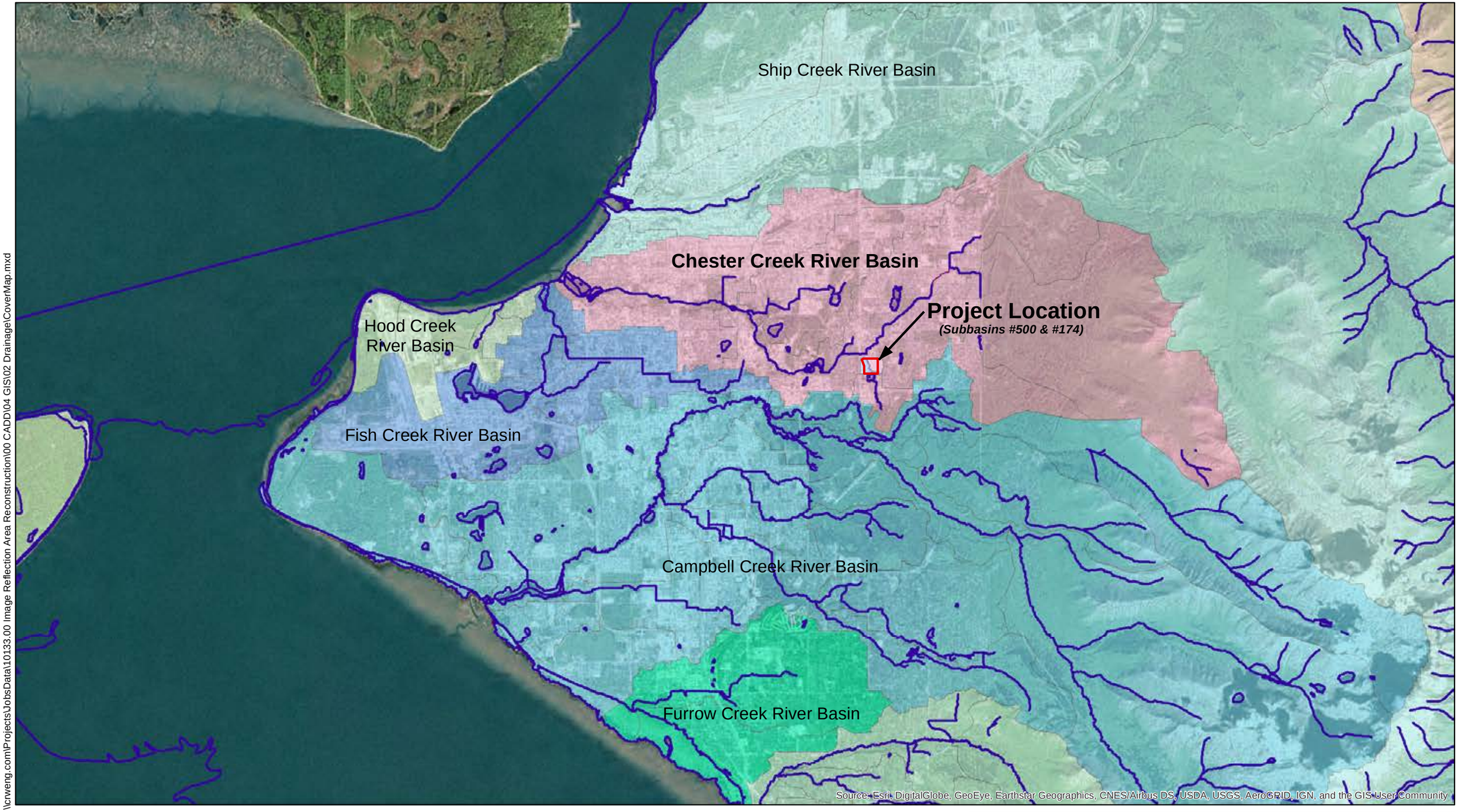
SHEET	PARCEL	CENTERLINE REFERENCE		EXISTING GRADE	PROPOSED GRADE	SURFACE TYPE ON PROPERTY	REMARKS
		STATION	OFFSET				
R7	58	216+95	LT	2.5%	4.6%	ASPHALT	REFLECTION DRIVE
R7	54	217+30	LT	7.3%	7.2%	ASPHALT	REFLECTION DRIVE
R7	49	217+45	RT	4.8%	3.7%	ASPHALT	REFLECTION DRIVE
R7	53	217+75	LT	14.6%	14.6%	ASPHALT	REFLECTION DRIVE
R7	50	217+84	RT	-5.6%	-6.2%	ASPHALT	REFLECTION DRIVE
R7	52	217+98	LT	14.8%	13.5%	ASPHALT	REFLECTION DRIVE
R7	51	218+37	LT	11.4%	9.9%	ASPHALT	REFLECTION DRIVE
R8	200	300+52	RT	6.1%	7.4%	ASPHALT	MIRAGE CIRCLE
R8	199	300+89	RT	7.3%	6.4%	ASPHALT	MIRAGE CIRCLE
R8	198	301+21	RT	3.6%	5.2%	ASPHALT	MIRAGE CIRCLE
R8	197	301+57	RT	3.3%	4.5%	ASPHALT	MIRAGE CIRCLE
R8	184	301+57	LT	6.9%	8.0%	ASPHALT	MIRAGE CIRCLE
R8	196	301+91	RT	5.5%	4.2%	ASPHALT	MIRAGE CIRCLE
R8	195	302+31	RT	5.7%	4.4%	ASPHALT	MIRAGE CIRCLE
R8	185	302+48	LT	5.2%	5.0%	ASPHALT	MIRAGE CIRCLE
R8	194	302+58	RT	6.4%	5.5%	ASPHALT	MIRAGE CIRCLE
R8	192	302+65	RT	2.9%	2.7%	ASPHALT	MIRAGE CIRCLE
R8	191	302+73	RT	4.0%	2.4%	ASPHALT	MIRAGE CIRCLE
R8	193	302+76	RT	5.6%	4.1%	ASPHALT	MIRAGE CIRCLE
R8	186	302+76	LT	6.8%	5.5%	ASPHALT	MIRAGE CIRCLE
R8	188	302+81	LT	6.6%	5.1%	ASPHALT	MIRAGE CIRCLE
R8	187	302+82	LT	6.4%	4.6%	ASPHALT	MIRAGE CIRCLE
R8	190	302+94	RT	2.6%	1.8%	ASPHALT	MIRAGE CIRCLE
R8	189	303+09	RT	5.8%	4.4%	ASPHALT	MIRAGE CIRCLE
R9	103	401+00	LT	14.0%	14.0%	ASPHALT	KEYANN CIRCLE
R9	89	401+39	RT	3.6%	4.0%	ASPHALT	KEYANN CIRCLE
R9	102	401+43	LT	10.5%	9.8%	ASPHALT	KEYANN CIRCLE
R9	90	401+75	RT	2.4%	2.6%	ASPHALT	KEYANN CIRCLE
R9	101	401+83	LT	4.9%	3.1%	ASPHALT	KEYANN CIRCLE
R9	94	401+99	RT	7.0%	6.4%	ASPHALT	KEYANN CIRCLE
R9	100	402+05	LT	3.8%	3.7%	ASPHALT	KEYANN CIRCLE
R9	92	402+14	RT	2.9%	3.8%	ASPHALT	KEYANN CIRCLE
R9	91	402+14	RT	2.1%	1.6%	ASPHALT	KEYANN CIRCLE
R9	95	402+25	RT	6.8%	5.9%	ASPHALT	KEYANN CIRCLE
R9	93	402+28	RT	3.8%	4.2%	ASPHALT	KEYANN CIRCLE
R9	98	402+35	LT	4.2%	4.1%	ASPHALT	KEYANN CIRCLE
R9	99	402+38	LT	6.7%	6.0%	ASPHALT	KEYANN CIRCLE
R9	97	402+61	LT	10.4%	10.3%	ASPHALT	KEYANN CIRCLE
R9	96	402+74	RT	12.6%	11.8%	ASPHALT	KEYANN CIRCLE

DRIVEWAY SUMMARY

SHEET	PARCEL	CENTERLINE REFERENCE		EXISTING GRADE	PROPOSED GRADE	SURFACE TYPE ON PROPERTY	REMARKS
		STATION	OFFSET				
R9	168	500+77	RT	2.9%	4.2%	ASPHALT	IMAGE CIRCLE
R9	167	501+15	RT	4.7%	6.7%	ASPHALT	IMAGE CIRCLE
R9	164	501+20	RT	0.1%	0.7%	ASPHALT	IMAGE CIRCLE
R9	165	501+23	RT	0.5%	1.2%	ASPHALT	IMAGE CIRCLE
R9	162	501+26	LT	5.0%	3.2%	ASPHALT	IMAGE CIRCLE
R9	160	501+30	LT	8.2%	7.0%	ASPHALT	IMAGE CIRCLE
R9	166	501+32	RT	3.4%	3.8%	ASPHALT	IMAGE CIRCLE
R9	159	501+32	LT	5.4%	6.1%	ASPHALT	IMAGE CIRCLE
R9	163	501+33	LT	3.5%	3.2%	ASPHALT	IMAGE CIRCLE
R9	161	501+34	LT	3.7%	3.5%	ASPHALT	IMAGE CIRCLE
R10	78	601+03	LT	5.3%	2.1%	ASPHALT	RIDGELAKE CIRCLE
R10	63	601+07	RT	2.0%	2.3%	ASPHALT	RIDGELAKE CIRCLE
R10	77	601+43	LT	4.6%	3.2%	ASPHALT	RIDGELAKE CIRCLE
R10	64	601+43	RT	5.2%	3.0%	ASPHALT	RIDGELAKE CIRCLE
R10	76	601+76	LT	4.1%	2.6%	ASPHALT	RIDGELAKE CIRCLE
R10	65	601+86	RT	3.6%	1.9%	ASPHALT	RIDGELAKE CIRCLE
R10	75	602+19	LT	4.9%	2.1%	ASPHALT	RIDGELAKE CIRCLE
R10	66	602+24	RT	8.0%	3.6%	ASPHALT	RIDGELAKE CIRCLE
R10	74	602+33	LT	6.8%	5.2%	ASPHALT	RIDGELAKE CIRCLE
R10	73	602+53	LT	10.6%	10.4%	ASPHALT	RIDGELAKE CIRCLE
R10	72	602+60	LT	15.0%	12.3%	ASPHALT	RIDGELAKE CIRCLE
R10	71	602+63	LT	16.8%	13.9%	ASPHALT	RIDGELAKE CIRCLE
R10	70	602+77	LT	14.8%	12.7%	ASPHALT	RIDGELAKE CIRCLE
R10	69	602+79	LT	15.0%	15.0%	ASPHALT	RIDGELAKE CIRCLE
R10	68	602+79	LT	15.6%	14.3%	ASPHALT	RIDGELAKE CIRCLE
R10	67	603+04	LT	9.4%	7.0%	ASPHALT	RIDGELAKE CIRCLE
R10	24	700+53	RT	13.2%	11.0%	ASPHALT	LOON COVE CIRCLE
R10	34	700+63	LT	6.1%	5.6%	ASPHALT	LOON COVE CIRCLE
R10	33	700+85	LT	5.8%	3.8%	ASPHALT	LOON COVE CIRCLE
R10	25	700+91	RT	9.3%	8.4%	ASPHALT	LOON COVE CIRCLE
R10	26	701+01	RT	8.6%	10.0%	ASPHALT	LOON COVE CIRCLE
R10	32	701+09	LT	7.5%	5.8%	ASPHALT	LOON COVE CIRCLE
R10	31	701+19	LT	8.1%	7.3%	ASPHALT	LOON COVE CIRCLE
R10	27	701+21	RT	12.4%	11.7%	ASPHALT	LOON COVE CIRCLE
R10	28	701+29	RT	13.7%	12.0%	ASPHALT	LOON COVE CIRCLE
R10	30	701+33	LT	14.1%	13.4%	ASPHALT	LOON COVE CIRCLE
R10	29	701+80	RT	12.2%	11.7%	ASPHALT	LOON COVE CIRCLE

Drainage Analysis

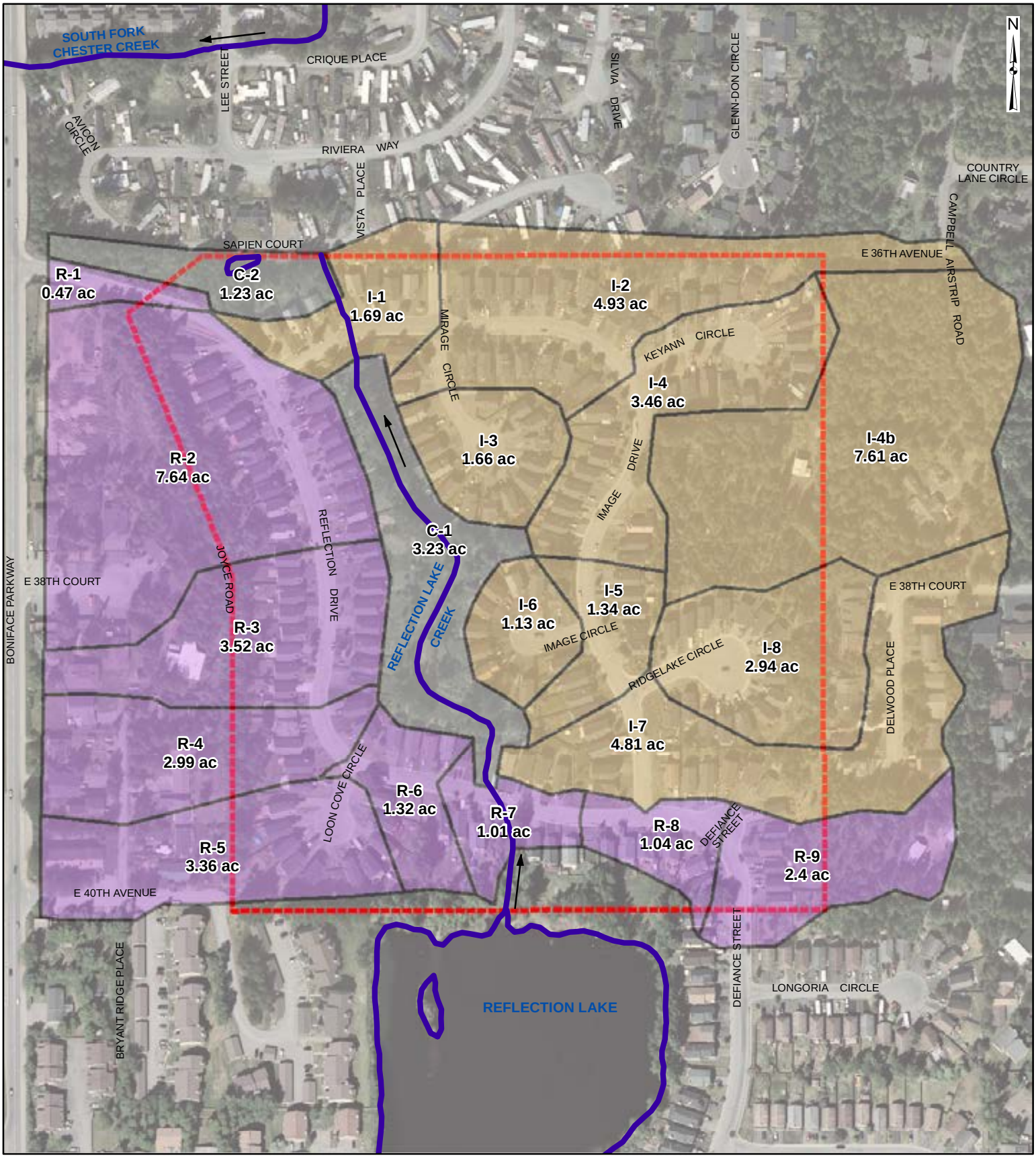
Appendix H



\\crweng.com\Projects\JobsData\10133.00 Image Reflection Area Reconstruction\00 CADD\04 GIS\02 Drainage\CoverMap.mxd

0 1 2 4 6 8 Miles

Project Location and Subbasins **Image/Reflection Area Reconstruction**	**Date: DEC 2017** **Figure: 1**



Legend

- Project Boundary
- Image Drainage System
- Reflection Drainage System
- Creek Drainage Areas

Catchment Areas (Existing Condition)

Image/Reflection Drive Area Reconstruction

CRW ENGINEERING GROUP, LLC

Figure: 2

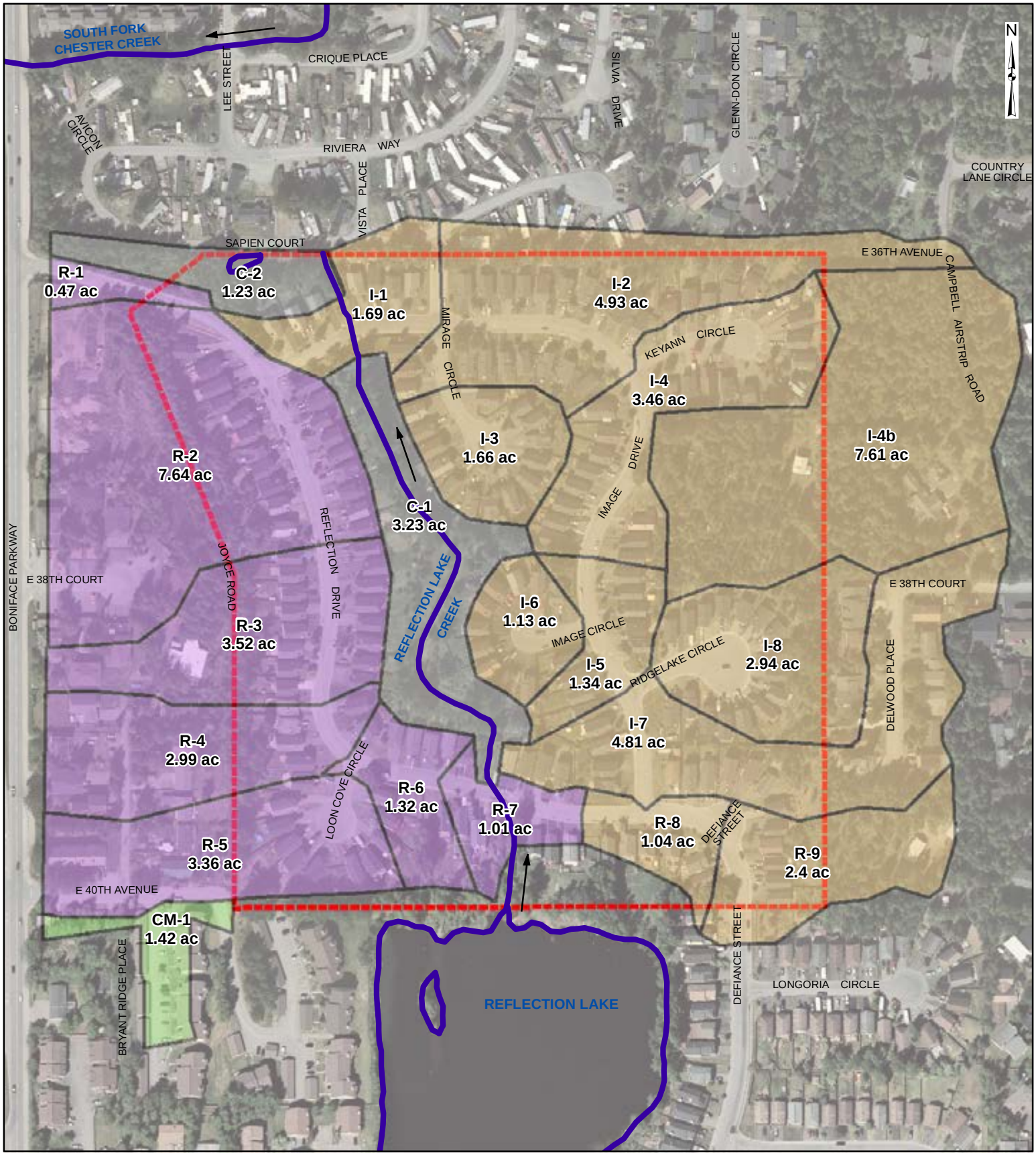
Date: Dec 2017

TABLE 1: CATCHMENT SUMMARY AND INPUT PARAMETERS (EXISTING CONDITION)

Catchment ID	Total Area (Acres)	Undisturbed Naturally Vegetated Areas	Directly Connected Impervious Areas (DCIA)	Contributing Grassed or other Landscaped Areas	% Impervious	Sum check (1.00)	Hydrologic Soil Group	SCS Curve Number	Composite T_c (min)	Composite T_c (hour)
R-1	0.47	0%	45%	55%	45%	1.00	C	**82.1**	**5.0**	**0.08**
R-2	7.64	0%	50%	50%	50%	1.00	C	**83.0**	**45.8**	**0.76**
R-3	3.52	0%	51%	49%	51%	1.00	C	**83.0**	**46.6**	**0.78**
R-4	2.99	0%	51%	49%	51%	1.00	C	**83.2**	**50.9**	**0.85**
R-5	3.36	0%	55%	45%	55%	1.00	C	**83.9**	**26.5**	**0.44**
R-6	1.32	0%	55%	45%	55%	1.00	C	**83.9**	**110.3**	**1.84**
R-7	1.01	0%	55%	45%	55%	1.00	C	**83.9**	**91.0**	**1.52**
R-8	1.04	0%	55%	45%	55%	1.00	C	**83.9**	**34.2**	**0.57**
R-9	2.40	53%	30%	17%	30%	1.00	C	**78.8**	**117.7**	**1.96**
I-1	1.69	0%	45%	55%	45%	1.00	C	**82.1**	**86.3**	**1.44**
I-2	4.93	11%	40%	49%	40%	1.00	C	**81.4**	**112.5**	**1.87**
I-3	1.66	0%	62%	38%	62%	1.00	C	**85.2**	**40.8**	**0.68**
I-4	3.46	0%	51%	49%	51%	1.00	C	**83.2**	**48.7**	**0.81**
I-4b	7.61	100%	0%	0%	0%	1.00	C	**73.0**	**86.1**	**1.44**
I-5	1.34	0%	51%	49%	51%	1.00	C	**83.1**	**55.2**	**0.92**
I-6	1.13	0%	62%	38%	62%	1.00	C	**85.2**	**49.5**	**0.83**
I-7	4.81	11%	45%	44%	45%	1.00	C	**82.0**	**75.2**	**1.25**
I-8	2.94	26%	42%	32%	42%	1.00	C	**81.2**	**29.1**	**0.48**

TABLE 2: CATCHMENT RUNOFF SUMMARY (EXISTING CONDITION)

Catchment	Area	Peak Runoff (cfs) 10-yr, 24-hr Storm (Conveyance Design)		Peak Runoff (cfs) 100-yr, 24-hr Storm (Flood Bypass)	
ID	(Acre)	(cfs)	(cfs/AC)	(cfs)	(cfs/AC)
Image Drive System					
I-1	1.69	0.40	0.24	0.86	0.51
I-2	4.93	0.97	0.20	2.12	0.43
I-3	1.66	0.72	0.43	1.43	0.86
I-4	3.46	1.21	0.35	2.53	0.73
I-4b	7.61	0.96	0.13	2.70	0.35
I-5	1.34	0.43	0.32	0.89	0.66
I-6	1.13	0.43	0.38	0.86	0.76
I-7	4.81	1.22	0.25	2.63	0.55
I-8	2.94	1.11	0.38	2.46	0.84
Reflection Drive System					
R-1	0.47	0.22	0.47	0.48	1.02
R-2	7.64	2.81	0.37	5.89	0.77
R-3	3.52	1.27	0.36	2.66	0.76
R-4	2.99	1.02	0.34	2.14	0.72
R-5	3.36	1.64	0.49	3.38	1.01
R-6	1.32	0.30	0.23	0.62	0.47
R-7	1.01	0.26	0.26	0.53	0.52
R-8	1.04	0.45	0.43	0.91	0.88
R-9	2.40	0.39	0.16	0.91	0.38



Legend

- Project Boundary
- Image Drainage System
- Reflection Drainage System
- Loon Cove Drainage Area
- Creek Drainage Areas

Catchment Areas
(Proposed Condition)

Image/Reflection Drive Area Reconstruction

CRW ENGINEERING GROUP, LLC

Figure: 3

Date: Dec 2017

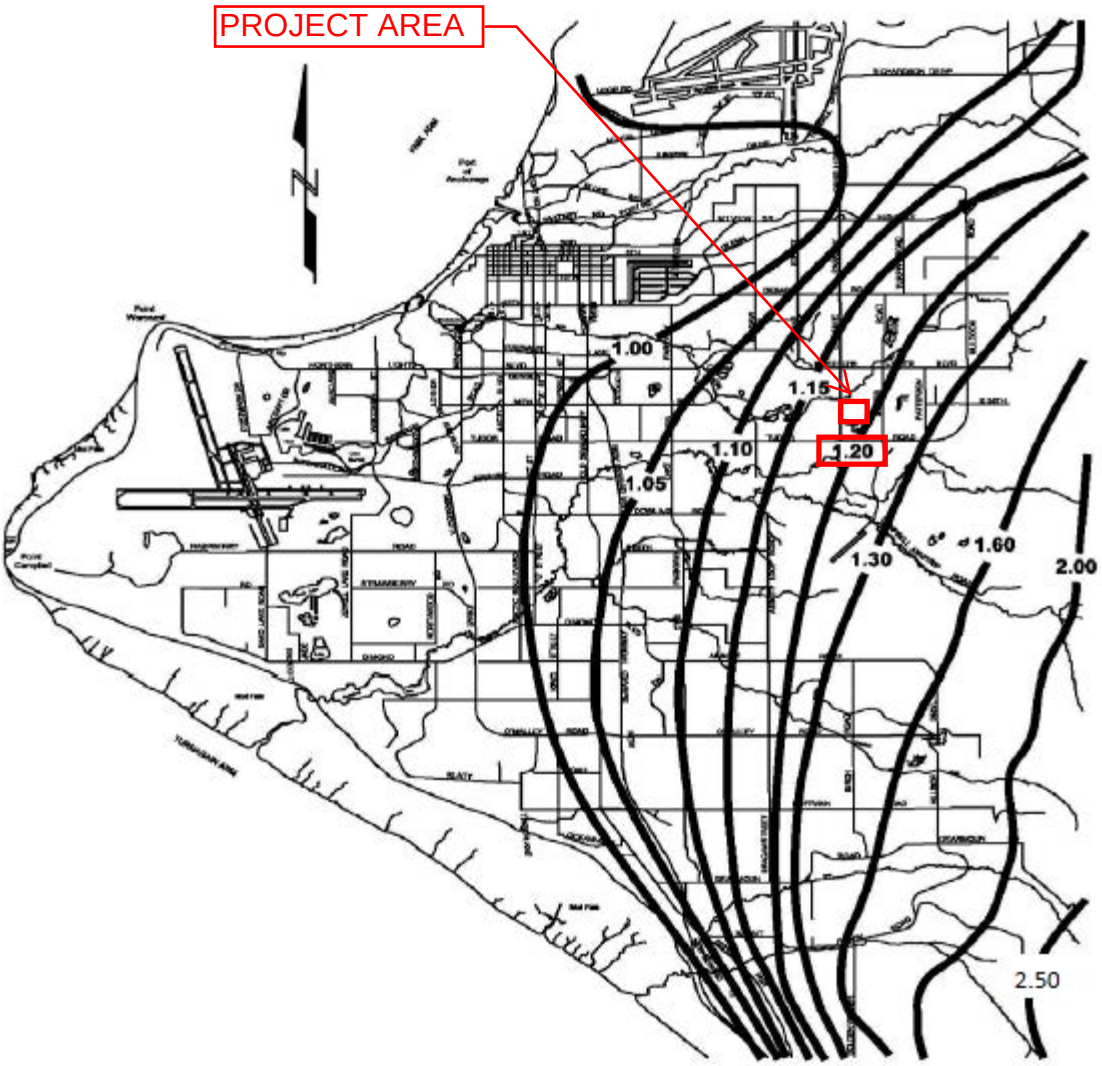
TABLE 3: CATCHMENT SUMMARY AND INPUT PARAMETERS (PROPOSED CONDITION)

Subcatchment ID	Total Area (Acres)	Undisturbed Naturally Vegetated Areas	Directly Connected Impervious Areas (DCIA)	Contributing Grassed or other Landscaped Areas	% Impervious	Sum check (1.00)	Hydrologic Soil Group	SCS Curve Number	Composite T_c (min)	Composite T_c (hour)
R-1	0.47	0%	45%	55%	45%	1.00	C	**82.1**	**5.0**	**0.08**
R-2	7.64	0%	50%	50%	50%	1.00	C	**83.0**	**45.8**	**0.76**
R-3	3.52	0%	51%	49%	51%	1.00	C	**83.0**	**46.6**	**0.78**
R-4	2.99	0%	51%	49%	51%	1.00	C	**83.2**	**50.9**	**0.85**
R-5	3.36	0%	55%	45%	55%	1.00	C	**83.9**	**26.5**	**0.44**
R-6	1.32	0%	55%	45%	55%	1.00	C	**83.9**	**110.3**	**1.84**
R-7	1.01	0%	55%	45%	55%	1.00	C	**83.9**	**91.0**	**1.52**
I-9	1.04	0%	55%	45%	55%	1.00	C	**83.9**	**34.2**	**0.57**
I-10	2.40	53%	30%	17%	30%	1.00	C	**78.8**	**117.7**	**1.96**
I-1	1.69	0%	45%	55%	45%	1.00	C	**82.1**	**86.3**	**1.44**
I-2	4.93	11%	40%	49%	40%	1.00	C	**81.4**	**112.5**	**1.87**
I-3	1.66	0%	62%	38%	62%	1.00	C	**85.2**	**40.8**	**0.68**
I-4	3.46	0%	51%	49%	51%	1.00	C	**83.2**	**48.7**	**0.81**
I-4b	7.61	100%	0%	0%	0%	1.00	C	**73.0**	**86.1**	**1.44**
I-5	1.34	0%	51%	49%	51%	1.00	C	**83.1**	**55.2**	**0.92**
I-6	1.13	0%	62%	38%	62%	1.00	C	**85.2**	**49.5**	**0.83**
I-7	4.81	11%	45%	44%	45%	1.00	C	**82.0**	**75.2**	**1.25**
I-8	2.94	26%	42%	32%	42%	1.00	C	**81.2**	**29.1**	**0.48**
CM-1	1.42	0%	94%	6%	94%	1.00	C	**90.9**	**5.0**	**0.08**

TABLE 4: CATCHMENT RUNOFF SUMMARY (PROPOSED CONDITION)

Catchment	Area	Peak Runoff (cfs) 10-yr, 24-hr Storm (Conveyance Design)		Peak Runoff (cfs) 100-yr, 24-hr Storm (Flood Bypass)	
ID	(Acre)	(cfs)	(cfs/AC)	(cfs)	(cfs/AC)
Image Drive System					
I-1	1.69	0.29	0.17	0.88	0.52
I-2	4.93	0.69	0.14	2.17	0.44
I-3	1.66	0.54	0.33	1.48	0.89
I-4	3.46	0.90	0.26	2.63	0.76
I-4b	7.61	0.56	0.07	2.75	0.36
I-5	1.34	0.32	0.24	0.94	0.70
I-6	1.13	0.33	0.29	0.91	0.81
I-7	4.81	0.89	0.19	2.72	0.57
I-8	2.94	0.88	0.30	2.77	0.94
I-9	1.04	0.34	0.33	0.98	0.94
I-10	2.40	0.26	0.11	0.93	0.39
Reflection Drive System					
R-1	0.47	0.31	0.66	0.91	1.94
R-2	7.64	2.03	0.27	5.99	0.78
R-3	3.52	0.93	0.26	2.73	0.78
R-4	2.99	0.76	0.25	2.22	0.74
R-5	3.36	1.28	0.38	3.64	1.08
R-6	1.32	0.22	0.17	0.64	0.48
R-7	1.01	0.19	0.19	0.55	0.54
E 40th Ave / Loon Cove Circle System					
CM-1	1.42	1.55	1.09	3.51	2.47

Figure 4.2-3: Orographic Factor Map (Anchorage)



Easement Spreadsheets and Existing ROW Drawings

Appendix I

Image Drive / Reflection Drive Area Road Reconstruction Required Easements & TCP's					
PARCEL	**PUE**	**SE**	**TCE**	**DE**	**# Of TCP's**
1					1
2					1
3					1
4					1
5					1
6					1
7					1
8					1
9					1
10					1
11					1
12					1
13					1
14					1
15					1
16					1
17					1
18					1
19					1
20					1
21					1
22					1
23					1
24					1
25					1
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27					1
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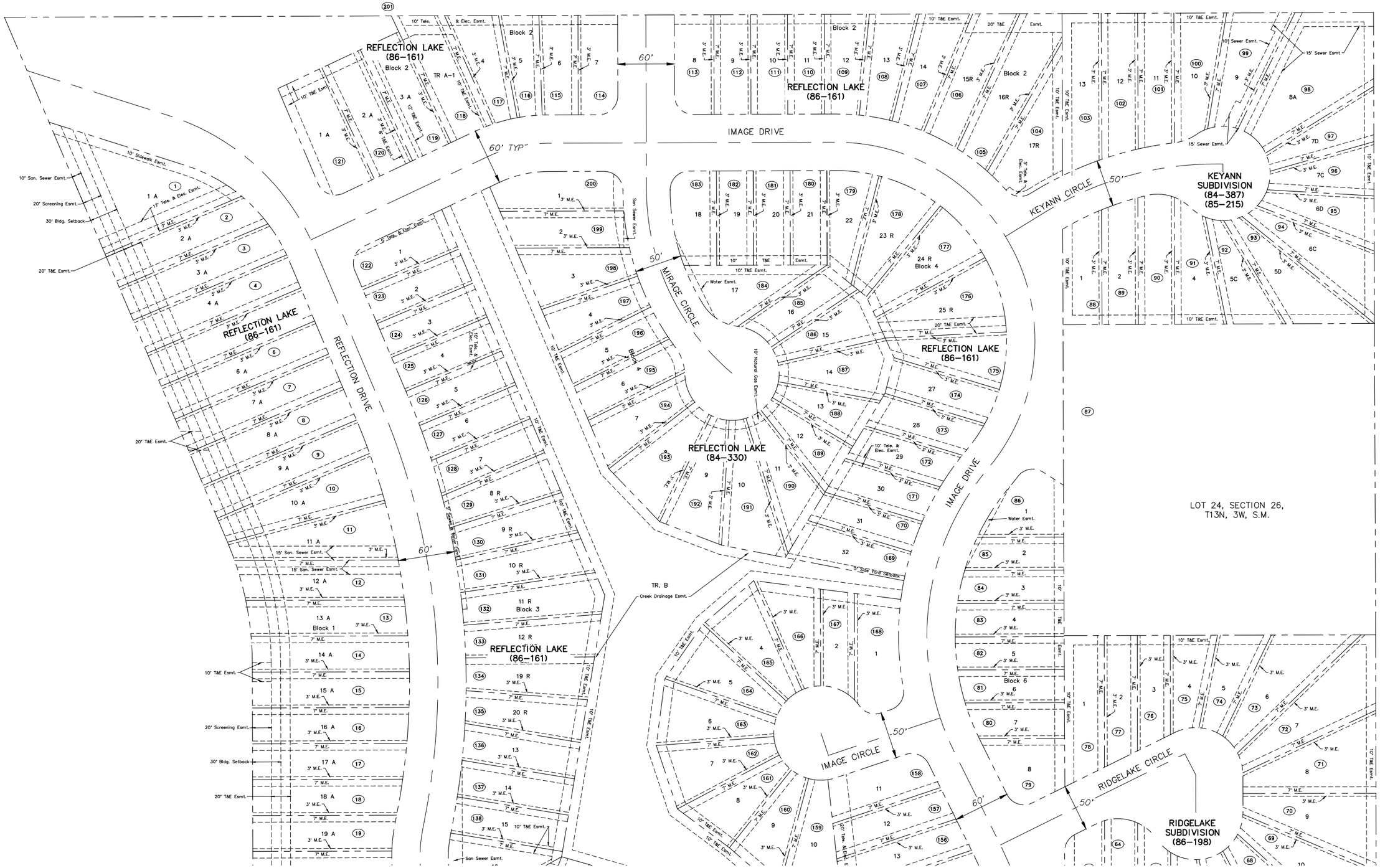
32					1
33					1
34					2
35					1
36					1
37					1
39					1
41					1
42					1
43					1
44					1
45					1
46					1
47					1
48					1
49					1
50					1
51					1
52					1
53					1

Image Drive / Reflection Drive Area Road Reconstruction Required Easements & TCP's					
PARCEL	PUE	SE	TCE	DE	# Of TCP's
54					1
55					1
56					1
57					1
58					1
59					1
60					1
61					1
62					1
63					1
64					1
65					1
66					1
67					1
68					1
69					1
70					1
71					1
72					1
73					1
74					1
75					1
76					1
77					1
78					1
79					2
80					1
81					1
82					1
83					1
84					1
85					1
86					1
88					1
89					1
90					1
91					1
92					1
93					1
94					1
95					1
96					1
97					1
98					1
99					1
100					1
101					1
102					1
103					1
104					1
105					1

Image Drive / Reflection Drive Area Road Reconstruction Required Easements & TCP's					
PARCEL	**PUE**	**SE**	**TCE**	**DE**	**# Of TCP's**
106					1
107					1
108					1
109					1
110					1
111					1
112					1
113					1
114					1
115					1
116					1
117					1
119					1
120					1
121	X		X		3
122					2
123					1
124					1
125					1
126					1
127				X	1
128				X	1
129				X	1
130				X	1
131				X	1
132				X	1
133					1
134					1
135					1
136					1
137					1
138					1
139					1
140					1
141					1
142					1
143					1
144					1
145					1
146					1
147					1
148					1
149					1
150					1
151					1
152					1
153					1
154					1
155					1
156					1
157					1

Image Drive / Reflection Drive Area Road Reconstruction Required Easements & TCP's					
PARCEL	**PUE**	**SE**	**TCE**	**DE**	**# Of TCP's**
158					1
159					1
160					1
161					1
162					1
163					1
164					1
165					1
166					1
167					1
168					2
169					1
170					1
171					1
172					1
173					1
174					1
175					1
176					1
177					1
178					1
179					1
180					1
181					1
182					1
183					1
184					1
185					1
186					1
187					1
188					1
189					1
190					1
191					1
192					1
193					1
194					1
195					1
196					1
197					1
198					1
199					1
200					2
201	X		X		1
TOTAL	**2**	**0**	**2**	**6**	**204**



50' 0 50' 100'

PROJECT:	10133.00
STATUS:	DSR

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

MUNICIPALITY OF ANCHORAGE

IMAGE DRIVE/REFLECTION DRIVE AREA
ROAD RECONSTRUCTION

EXISTING ROW MAP

DATE	DEC 2017
SCALE	GRAPHIC
FIGURE	1 OF 2

File: J:\Jobsdata\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\ROW\10133.00 ROW-Easement Map.dwg

50' 0 50' 100'

PROJECT: 10133.00 STATUS: DSR	CRW ENGINEERING GROUP, LLC 3940 ARCTIC BLVD. SUITE 300 ANCHORAGE, ALASKA 99503 PHONE: (907) 562-3252 #AECL882-AK	MUNICIPALITY OF ANCHORAGE	IMAGE DRIVE/REFLECTION DRIVE AREA ROAD RECONSTRUCTION EXISTING ROW MAP	DATE: DEC 2017 SCALE: GRAPHIC FIGURE: 2 OF 2

File: J:\Jobsdata\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\01 DSR\ROW\10133.00 ROW-Easement Map.dwg

Project Cost Estimates

Appendix J

Image Drive/Reflection Drive Area Road Reconstruction
MOA Project No. 14-50

ENGINEER'S ESTIMATE - DRAFT DSR

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 (Type 3)	LS	1	1.00	0	1	$60,000	$60,000
A-2	20.03	Test Pit for Utility Locate	Hour	16	1.00	0	16	$800	$12,800
A-3	20.04	Clearing and Grubbing	LS	1	1.00	0	1	$45,000	$45,000
A-4	20.07	Remove Sidewalk or Concrete Apron	SY	2,166	1.00	0	2,166	$15	$32,490
A-5	20.08	Remove Curb and Gutter	LF	9,693	1.00	0	9,693	$8	$77,544
A-6	20.09	Remove Pavement	SY	25,292	1.00	0	25,292	$3	$75,876
A-7	20.10	Unusable Excavation	CY	38,242	1.20	-2	45,900	$13	$596,700
A-8	20.12	Dewatering	LS	1	1.00	0	1	$30,000	$30,000
A-9	20.21	Classified Fill and Backfill (Type II)	Ton	31,835	1.20	-2	38,200	$16	$611,200
A-10	20.21	Classified Fill and Backfill (Type II-A)	Ton	33,658	1.20	-2	40,400	$16	$646,400
A-11	20.22	Leveling Course	Ton	2,718	1.08	-1	2,940	$32	$94,080
A-12	20.25	Geotextile (Type A)	SY	29,386	1.00	-1	29,390	$1.50	$44,085
A-13	20.26	Insulation Board (R-4.5)	SF	15,440	1.01	-1	15,590	$1	$15,590
A-14	20.26	Insulation Board (R-9)	SF	220,397	1.01	-1	222,600	$1.50	$333,900
A-15	30.02	P.C.C. Curb and Gutter (All Types)	LF	9,571	1.00	0	9,571	$25	$239,275
A-16	30.03	P.C.C. Sidewalk (Standard Finish)	SY	2,648	1.00	0	2,648	$60	$158,880
A-17	30.04	P.C.C. Curb Ramp (6" Thick)	EA	14	1.00	0	14	$3,000	$42,000
A-18	40.06	A.C. Pavement (Class E)	Ton	2,814	1.06	0	2,982	$110	$328,020
A-19	40.07	Asphalt Speed Hump	EA	4	1.00	0	4	$3,500	$14,000
A-20	50.06	Remove and Replace Manhole Cone Section	EA	3	1.00	0	3	$1,400	$4,200
A-21	50.06	Remove and Replace Manhole Cover and Frame	EA	19	1.00	0	19	$700	$13,300
A-22	50.09	Adjust Cleanout to Finish Grade	EA	8	1.00	0	8	$500	$4,000
A-23	60.03	Remove and Replace Valve Box Top Section	EA	25	1.00	0	25	$500	$12,500
A-24	60.05	Adjust Key Box	EA	103	1.00	0	103	$450	$46,350
A-25	65.02	Construction Survey Measurement	LS	1	1.00	0	1	$110,000	$110,000
A-26	65.02	Two-Person Survey Crew	Hour	40	1.00	0	40	$240	$9,600
A-27	70.08	Remove and Reset Fence	LF	908	1.00	0	908	$35	$31,780
A-28	70.11	Standard Sign	SF	180	1.00	0	180	$80	$14,400
A-29	70.12	Traffic Maintenance	LS	1	1.00	0	1	$400,000	$400,000
A-30	70.16	Temporary Group Mailboxes	LS	1	1.00	0	1	$10,000	$10,000
A-31	70.17	Relocate Mailbox	EA	28	1.00	0	28	$500	$14,000
A-32	70.17	Relocate Cluster Mailbox Unit	EA	11	1.00	0	11	$3,000	$33,000
A-33	70.22	Remove and Relocate Shed	EA	1	1.00	0	1	$1,600	$1,600
A-34	70.23	Temporary Fencing	LF	908	1.00	0	908	$8	$7,264
A-35	75.02	Landscape Trees/Shrubs	LS	1	1.00	0	1	$75,000	$75,000
A-36	75.03	Topsoil (4" Depth)	MSF	21.5	1.30	0	28	$500	$14,000
A-37	75.04	Seeding (Schedule A)	MSF	21.5	1.30	0	28	$500	$14,000
A-38	75.10	Remove and Reset Landscape Modular Blocks	LS	1	1.00	0	1	$10,000	$10,000
A-39	75.11	Salvage and Relocate or Dispose Existing Boulder	EA	21	1.00	0	21	$250	$5,250
								TOTAL	**$4,288,084**
Schedule B - Drainage Improvements									
B-1	20.13	Trench Dewatering	LS	1	1.00	0	1	$50,000	$50,000
B-2	20.13	Trench Excavation and Backfill (Various Depths)	LF	5,386	1.00	0	5,386	$35	$188,510
B-3	20.15	Furnish Trench Backfill (Type II)	Ton	1,000	1.20	0	1,200	$20	$24,000
B-4	20.16	Bedding Material (Class D)	LF	897	1.00	0	897	$34	$30,498
B-5	20.27	Disposal of Unusable or Surplus Material	CY	1,000	1.20	0	1,200	$18	$21,600
B-6	20.31	Stream Substrate	CY	14	1.30	0	19	$150	$2,850
B-7	50.04	Raise or Lower Sewer Service	LF	800	1.00	0	800	$150	$120,000
B-8	55.02	Furnish, Install, and Televise Pipe (12-Inch, Type S, CPEP)	LF	549	1.00	0	549	$62	$34,038
B-9	55.02	Furnish, Install, and Televise Pipe (24-Inch, Type S, CPEP)	LF	41	1.00	0	41	$70	$2,870
B-10	55.03	Furnish and Install Subdrain with Geotextile (8-Inch, Type SP, CPEP, Cla	LF	161	1.00	0	161	$49	$7,889
B-11	55.03	Furnish, Install, and Televise Subdrain with Geotextile (12-Inch, Type SP,	LF	701	1.00	0	701	$58	$40,658
B-12	55.03	Furnish, Install, and Televise Subdrain with Geotextile (18-Inch, Type SP,	LF	3,627	1.00	0	3,627	$74	$268,398
B-13	55.04	Connect to Existing Storm Drain System	EA	2	1.00	0	2	$3,000	$6,000
B-14	55.05	Construct (Type I) Manhole	EA	41	1.00	0	41	$5,700	$233,700
B-15	55.05	Construct (Type II) Manhole	EA	2	1.00	0	2	$9,800	$19,600
B-16	55.05	Construct (Type II) Catch Basin Manhole	EA	5	1.00	0	5	$8,700	$43,500
B-17	55.05	Construct (Type II) Bypass Manhole	EA	1	1.00	0	1	$15,000	$15,000
B-18	55.05	Construct (Type II) Flow Control Manhole	EA	1	1.00	0	1	$15,000	$15,000
B-19	55.09	Construct Catch Basin	EA	24	1.00	0	24	$4,200	$100,800
B-20	55.11	Remove Manhole	EA	30	1.00	0	30	$1,300	$39,000
B-21	55.11	Remove Catch Basin	EA	20	1.00	0	20	$1,200	$24,000
B-22	55.18	Construct Footing Drain Service (6-inch)	EA	200	1.00	0	200	$2,200	$440,000
B-23	55.20	Furnish and Install Culvert w/End Sections (24-Inch, Type S, CPEP)	LF	154	1.00	0	154	$100	$15,400
B-24	55.20	Furnish and Install Culvert w/End Sections (36-Inch, CMP)	LF	153	1.00	0	153	$180	$27,540
B-25	55.22	Oil and Grit Separator	EA	1	1.00	0	1	$50,000	$50,000
B-26	55.23	Heat Trace System	LS	1	1.00	0	1	$131,780	$131,780
B-27	55.27	Storm Drain Bypass System	LS	1	1.00	0	1	$30,000	$30,000
B-28	55.28	Storm Drain Detention System	LS	1	1.00	0	1	$50,000	$50,000
B-29	55.29	Furnish and Install Stormwater Lift Station	LS	1	1.00	0	1	$1,008,450	$1,008,450
B-30	55.30	Construct Detention Basin	LS	1	1.00	0	1	$121,455	$121,455
B-31	60.05	Furnish and Install (1" Copper) Water Service Line	LF	400	1.00	0	400	$150	$60,000

Image Drive/Reflection Drive Area Road Reconstruction
MOA Project No. 14-50

ENGINEER'S ESTIMATE - DRAFT DSR

ITEM No.	MASS No.	ITEM DESCRIPTION	UNIT	CALC. QUANT	CONT. FACTOR	ROUND FACTOR	EST QUANT	UNIT PRICE	TOTAL COST
B-32	70.07	Remove Pipe	LF	4,794	1.00	0	4,794	$21	$100,674
B-33	70.23	Stream Diversion	LS	1	1.00	0	1	$40,000	$40,000
								TOTAL	**$3,363,210**

Schedule C - Illumination Improvements

C-1	80.01	Temporary Illumination	LS	1	1.00	0	1	$10,000	$10,000
C-2	80.02	Trench and Backfill (2'W x 3.5'D)	LF	4,580	1.10	-1	5,040	$9.00	$45,360.00
C-3	80.04	Driven Pile Luminaire Pole Foundations	EA	32	1.00	0	32	$1,800.00	$57,600.00
C-4	80.04	Load Center Foundation (Type 1A)	EA	2	1.00	0	2	$4,000.00	$8,000.00
C-5	80.05	25-28 Ft. Fixed Base Luminaire Pole	EA	32	1.00	0	32	$3,000.00	$96,000.00
C-6	80.05	Luminaire Arm (10 - 20 Ft. Length)	EA	35	1.00	0	35	$700.00	$24,500.00
C-7	80.07	Steel Conduit (2 inch)	FT	5000	1.10	-1	5,500	$17.00	$93,500.00
C-8	80.08	Junction Box (Type IA)	EA	38	1.00	0	38	$700.00	$26,600.00
C-9	80.08	Junction Box (Type II)	EA	6	1.00	0	6	$1,600.00	$9,600.00
C-10	80.08	Remove Junction Box	EA	17	1.00	0	17	$500.00	$8,500.00
C-11	80.10	3 Conductor 8 AWG Type XHHW-2 Cable	FT	6915	1.10	-1	7,610	$4.00	$30,440.00
C-12	80.14	Single-Meter Pad-Mount Load Center, Type 1A with Lighting Control	EA	2	1.00	0	2	$7,000.00	$14,000.00
C-13	80.23	Luminaire (40 LED, Medium, Type 2)	EA	23	1.00	0	23	$1,150.00	$26,450.00
C-14	80.23	Luminaire (60 LED, Medium, Type 2)	EA	6	1.00	0	6	$1,200.00	$7,200.00
C-15	80.23	Luminaire (60 LED, Medium, Type 3)	EA	1	1.00	0	1	$1,250.00	$1,250.00
C-16	80.23	Luminaire (60 LED, Medium, Type 4)	EA	4	1.00	0	4	$1,250.00	$5,000.00
C-17	80.23	Luminaire (80 LED, Medium, Type 4)	EA	1	1.00	0	1	$1,250.00	$1,250.00
C-18	80.23	Spare Luminaire (40 LED, Medium, Type 2)	EA	2	1.00	0	2	$1,000.00	$2,000.00
C-19	80.23	Spare Luminaire (60 LED, Medium, Type 2)	EA	1	1.00	0	1	$1,050.00	$1,050.00
C-20	80.23	Spare Luminaire (60 LED, Medium, Type 3)	EA	1	1.00	0	1	$1,050.00	$1,050.00
C-21	80.23	Spare Luminaire (60 LED, Medium, Type 4)	EA	1	1.00	0	1	$1,100.00	$1,100.00
C-22	80.23	Spare Luminaire (80 LED, Medium, Type 4)	EA	1	1.00	0	1	$1,100.00	$1,100.00
C-23	80.28	Remove Load Center	EA	1	1.00	0	1	$1,500.00	$1,500.00
C-24	80.28	Remove Luminaire Pole	EA	29	1.00	0	29	$700.00	$20,300.00
								TOTAL	**$493,350**

Schedule D - Water Improvements

D-1	20.13	Trench Excavation & Backfill (various depths)	LF	98	1.20	0	118	$35.00	$4,130.00
D-2	20.15	Furnish Trench Backfill (Type II)	TON	486	1.20	-1	580	$16.00	$9,280
D-3	20.16	Bedding Material (Class E)	LF	98	1.20	0	118	$37.00	$4,366
D-4	20.26	Insulation Board (R=20)	SF	392	1.00	0	392	$5.00	$1,960
D-5	20.27	Disposal of Unusable or Surplus Material	CY	273	1.40	-2	400	$14.00	$5,600
D-6	60.02	Furnish and Install (8", C900 RJIB PVC DR18) Pipe	LF	98	1.00	0	98	$185.00	$18,130
D-7	60.03	Furnish and Install (8") Gate Valve	EA	1	1.00	0	1	$9,000.00	$9,000
D-8	60.04	Furnish and Install Fire Hydrant Assembly (Single Pumper)	EA	2	1.00	0	2	$12,000.00	$24,000
D-9	60.05	Furnish and Install (1" Copper) Water Service Line	LF	72	1.00	0	72	$200.00	$14,400
D-10	60.05	Furnish and Install (2" Copper) Water Service Line	LF	100	1.00	0	100	$300.00	$30,000
D-11	60.06	Furnish and Install Anode	EA	5	1.00	0	5	$450.00	$2,250
D-12	60.07	Temporary Water System	LS	1	1.00	0	1	$25,000.00	$25,000
D-13	60.08	Decommission Fire Hydrant Assembly (Single Pumper)	EA	2	1.00	0	2	$3,500.00	$7,000
D-14	60.09	Adjust Fire Hydrant to Finished Grade	EA	3	1.00	0	3	$500.00	$1,500
D-15	70.07	Remove Pipe	LF	90	1.00	0	90	$30.00	$2,700
								TOTAL	**$159,316**

SUMMARY

Schedule A - Roadway Improvements	$4,288,084
Schedule B - Drainage Improvements	$3,363,210
Schedule C - Illumination Improvements	$493,350
Schedule D - Water Improvements	$159,316
Subtotal	$8,303,960
15% Construction Contingency	$1,246,000
Total Estimated Construction Cost:	**$9,550,000**

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS:
SUMMARY

Utility Relocation Summary- Image/Reflection

Natural Gas (Enstar)	$426,000
Telecommunications (ACS)	$26,000
Cable Television (GCI)	$96,000
Electric (CEA)	$52,000
Subtotal:	**$600,000**
Construction Contingency (10%)	**$60,000**
Total Utility Relocation Cost:	**$660,000**

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Natural Gas (Enstar)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	UNIT	QUANTITY	UNIT PRICE	COST
Image Drive									
G-1	100+27	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Subdrain	Verify depth, lower in place as needed	FT	45	$125	$5,639
G-2	102+65	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-3	102+71	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-4	103+32	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-5	103+55	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	50	$125	$6,250
G-6	104+52	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-7	104+87	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, protect in place	EA	1	$2,500	$2,500
G-8	104+93	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, protect in place	EA	1	$2,500	$2,500
G-9	105+29	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$125	$5,250
G-10	105+64	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-11	105+72	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-12	106+01	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain Catch Basin	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-13	106+63	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Natural Gas (Enstar)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	UNIT	QUANTITY	UNIT PRICE	COST
G-14	106+86	LT	5/8" plastic service	Potential conflict with proposed footing service	Verify depth, protect in place	EA	1	$2,500	$2,500
G-15	107+00	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, protect in place	EA	1	$2,500	$2,500
G-16	107+20	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, protect in place	EA	1	$2,500	$2,500
G-17	107+34	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-18	108+18	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	46	$108	$4,924
G-19	108+21	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-20	109+37	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-21	109+78	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-22	110+20	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-23	110+59	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-24	111+69	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-25	112+51	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-26	113+30	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	46	$108	$5,016
G-27	114+66	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	57	$125	$7,173
G-28	117+13	Crossing	2" plastic main	Within Roadway Typical Section	Verify depth, lower in place as needed	FT	48	$125	$5,975

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Natural Gas (Enstar)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	UNIT	QUANTITY	UNIT PRICE	COST
Reflection Drive									
G-29	200+90	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	47	$125	$5,871
G-30	201+54	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-31	201+55 to 203+74	LT	2" plastic main	Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	222	$75	$16,643
G-32	202+35	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-33	203+12	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$125	$5,250
G-34	203+97	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-35	204+01	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	48	$108	$5,139
G-36	204+30	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-37	204+47	LT	2" plastic main	Conflict with Proposed Storm Drain	Verify depth, protect in place	FT	111	$125	$13,875
G-38	205+14	LT	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$125	$5,250
G-39	205+93	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,538
G-40	206+75	LT	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	44	$125	$5,481
G-41	207+54	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$108	$4,536
G-42	208+24	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	43	$108	$4,647

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Natural Gas (Enstar)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	UNIT	QUANTITY	UNIT PRICE	COST
G-43	208+98	Crossing	1" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	46	$108	$5,006
G-44	209+24	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	43	$125	$5,331
G-45	209+54	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-46	210+07	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-47	210+53	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-48	210+84	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-49	211+17	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-50	211+30	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$125	$5,250
G-51	211+55	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-52	211+79	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-53	212+37	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-54	212+73	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-55	214+27	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	42	$125	$5,250
G-56	218+19	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	45	$125	$5,660

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Natural Gas (Enstar)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	UNIT	QUANTITY	UNIT PRICE	COST
Mirage Circle									
G-57	300+25	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	44	$125	$5,508
G-58	300+39	RT	2" plastic main	Conflict with proposed storm drain catch basin	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-59	301+01	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-60	301+10	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-61	301+62	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-62	302+62 to 303+16	LT	2" plastic main	Within Roadway Typical Section / Potential conflict with proposed footing services	Verify depth, lower in place as needed	FT	73	$125	$9,113
Keyann Circle									
G-63	400+87	Crossing	1" plastic main	Within Roadway Typical Section	Verify depth, lower in place as needed	FT	38	$108	$4,072
G-64	402+57 to 402+86	RT	2" plastic main	Within Roadway Typical Section	Verify depth, lower in place as needed	FT	38	$125	$4,774
Image Circle									
G-65	500+27	Crossing	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	43	$125	$5,386
G-66	500+27	RT	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain Catch Basin	Verify depth, lower in place as needed	FT	14	$125	$1,750
G-67	500+53	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-68	500+86	RT	2" plastic main	Within Roadway Typical Section	Verify depth, lower in place as needed	FT	15	$125	$1,875
G-69	500+98	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-70	501+21	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Natural Gas (Enstar)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	UNIT	QUANTITY	UNIT PRICE	COST
Ridgelake Circle									
G-71	600+90	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-72	601+13	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-73	601+26	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
Loon Cove Circle									
G-74	700+54	LT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-75	700+79	RT	2" plastic main	Potential conflict with proposed footing service	Verify depth, lower in place as needed	EA	1	$2,500	$2,500
G-76	701+01 to 701+10	LT/RT	2" plastic main	Within Roadway Typical Section / Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	FT	192	$125	$24,000

Construction Costs:	$328,000
Engineering/Administration (30%)	$98,000
Total:	**$426,000**

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Telephone Communication (ACS)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST
Image Drive									
T-1	101+35	Crossing	UG 50 pair telephone in 4" PVC conduit	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$2,000	$2,000
T-2	102+11	Crossing	UG 200 pair telephone	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$2,500	$2,500
T-3	108+95	Crossing	UG 200 pair telephone	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$2,500	$2,500
T-4	112+10	Crossing	UG 200 pair telephone	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$2,500	$2,500
Reflection Drive									
T-5	200+36	Crossing	UG 400 pair telephone	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$3,000	$3,000
T-6	214+01	Crossing	UG 200 pair telephone	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$2,500	$2,500
T-7	215+75	Crossing	UG 100 pair telephone	Within Roadway Structural Section / Possible conflict with proposed storm drain	Verify depth, lower in place as needed	1	EACH	$2,250	$2,250
T-8	218+59	Crossing	UG Telephone line	Within Roadway Structural Section	Verify depth, lower in place as needed	1	EACH	$3,000	$3,000

Construction Costs:	$20,000
Engineering/Administration (30%):	$6,000
Total:	**$26,000**

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Electric (CEA)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST
Image Drive									
E-1	101+36	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
E-2	102+10	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
E-3	108+95	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
E-4	112+12	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
Reflection Drive									
E-5	200+34	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
E-6	208+61	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
E-7	214+00	Crossing	UG single phase	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	1	EA	$5,000	$5,000
E-8	218+60	Crossing	UG single phase	Within Roadway Typical Section	Verify depth, lower in place as needed	1	EA	$5,000	$5,000

Construction Costs:	$40,000
Engineering/Administration	$12,000
Total:	**$52,000**

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Cable Communication (GCI)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST
Image Drive									
C-1	101+41	Crossing	UG .500 coaxial cable	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$70	$3,500
C-2	108+99	Crossing	UG .500 coaxial cable	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$70	$3,500
C-3	108+99 to 109+78	LT	UG .500 coaxial cable	Within Roadway Typical Section	Verify depth, lower in place as needed	79	LF	$70	$5,530
C-4	112+15	Crossing	UG .500 coaxial cable	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$70	$3,500
Reflection Drive									
C-5	200+41	Crossing	UG .500 coaxial cable	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	85	LF	$70	$5,950
C-6	208+58	Crossing	UG .500 coaxial cable	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$70	$3,500
C-7	213+07 to 215+57	RT	UG Fiber Optic	Within Roadway Typical Section / Possible Conflict with Proposed Footing Drain Services	Verify depth, lower in place as needed	50	LF	$120	$6,000
C-8	215+64	Crossing	UG Fiber Optic	Within Roadway Typical Section / Possible Conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$120	$6,000
C-9	215+72	Crossing	UG .500 coaxial cable	Within Roadway Typical Section	Verify depth, lower in place as needed	50	LF	$70	$3,500
C-10	218+55	Crossing	UG .500 coaxial cable	Within Roadway Typical Section	Verify depth, lower in place as needed	50	LF	$70	$3,500

IMAGE-REFLECTION DRIVE
UTILITY COST ANALYSIS
Cable Communication (GCI)

Id No.	APPROX. STATION	OFFSET	UTILITY CONFLICT	DESCRIPTION OF CONFLICT	RECOMMENDED ACTION	AMOUNT	UNIT	UNIT PRICE	COST
Keyann Circle									
C-11	400+35	Crossing	UG .750 coaxial cable	Within Roadway Typical Section	Verify depth, lower in place as needed	50	LF	$80	$4,000
C-12	400+65	Crossing	UG Fiber Optic	Within Roadway Typical Section	Verify depth, lower in place as needed	50	LF	$120	$6,000
Ridgelake Circle									
C-13	600+64	Crossing	UG Fiber Optic	Within Roadway Typical Section / Possible conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$120	$6,000
C-14	600+71	Crossing	UG .500 coaxial cable	Within Roadway Typical Section / Possible conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$70	$3,500
C-15	600+72	Crossing	UG .750 coaxial cable	Within Roadway Typical Section / Possible conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$80	$4,000
Loon Cove Circle									
C-16	700+79	Crossing	UG Fiber Optic	Within Roadway Typical Section / Possible conflict with Proposed Storm Drain	Verify depth, lower in place as needed	50	LF	$120	$6,000

Construction Costs:	$74,000
Engineering/Administration (30%)	$22,000
Total:	**$96,000**

Date: 12/22/2017 **Basis:** **Prepared By: CRW** **Ver. 5.1**

Project: Image Drive / Reflection Drive Area Road Reconstruction

Project Number: 14-50 [B]=local bond; [S]=state grant; [F]= federal grant

DESIGN	Design Management	$107,951		
Start 20??	PM&E Design Services	$0		
	PM&E Design Survey	$0		
	PM&E Design Soil	$0		
	Contractual Dsgn Sers (Basic)	$1,515,000		
	Contractual Dsgn Sers (Add'l)	$530,000		
	Contractual Design Survey	$110,000		
	Contractual Design Soils	$75,000		
	Miscellaneous	$0		
Subtotal			$2,337,951	
UTILITIES	AWWU	$0		
Start 20??	Enstar	$469,000		
	CEA	$57,000		
	ML&P	$0		
	ACS	$29,000		
	GCI	$106,000		
Subtotal			$661,000	
ROW	Real Estate Services	$80,000		
Start 20??	Land Acquisition	$30,000		
Subtotal			$110,000	
CONSTRUCTION	Construction Management	$149,471		
Start 20??	Inspection	$390,286		
	Materials Testing	$83,040		
	Survey	$58,128		
	Miscellaneous	$0		
	Construction Contract	$8,303,960		
Subtotal			$8,984,885	
MISCELLANEOUS	Bond Overhead (15.0%)	$2,354,017		
	Grant Overhead (0.0%)	$0		
	Contingency (15%)	$1,245,594		
Subtotal			$3,599,611	
PROJECT TOTAL			$15,693,447	

WEBPAGE DATA	
Environ	$0
DS	$584,488
Prelim Dsgn	$1,168,976
Final Dsgn	$584,488
ROW	$110,000
Utilities	$661,000
Const	$12,584,496
Total	$15,693,447

Public and Stakeholder Involvement

Appendix K

Justin Keene

From: Image/Reflection Area Road Reconstruction Project <cevans@crweng.ccsend.com> on behalf of Image/Reflection Area Road Reconstruction Project <comments@crweng.com>
Sent: Wednesday, March 09, 2016 10:25 AM
To: Justin Keene
Subject: Image/Reflection Area Road Reconstruction

Categories: Filed by Newforma

How to get involved:

- Attend the University Area Community Council Meeting: The project team will present updates at a few council meetings starting in the fall of 2016.
- Attend a public open house: Two open houses are planned during the Draft DSR phase.
- Visit the project website for meeting schedules, project documents, and to sign up for e-mail updates.
- Fill out a project questionnaire, which will be mailed to you later this spring.

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

Justin Keene, Project Manager
CRW Engineering Group LLC
562-3252 ● comments@crweng.com

www.ImageReflectionDrive.com

PM&E Project # 14-50

IMAGE DRIVE / REFLECTION DRIVE AREA ROAD RECONSTRUCTION

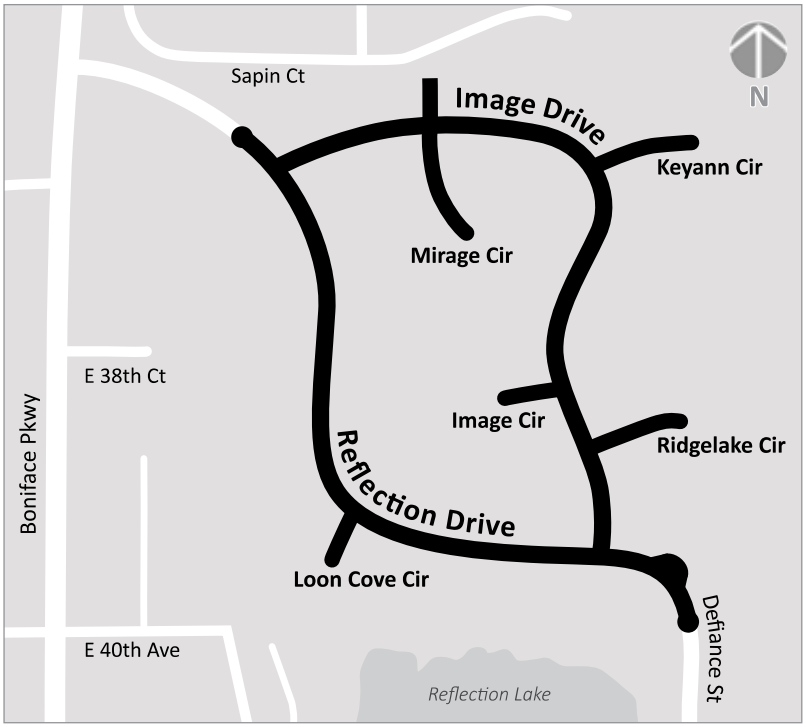
The Municipality of Anchorage (MOA) is planning to upgrade the Image/Reflection Drive area *(see map on back)*.

Improvements are expected to include:

- New road foundation
- New asphalt pavement
- New storm drain system
- Improved pedestrian facilities
- Improved street lighting

The MOA has contracted with CRW Engineering Group, LLC to provide preliminary engineering and design services. The project is funded through the Draft Design Study Report (DSR) phase. No funding for construction has been received at this time.

Starting in March, expect to see geotechnical and survey crews in your neighborhood. They will be drilling within the public right-of-way to collect soil and groundwater data, and mapping important features including driveways, utilities, and building corners. Thank you in advance for your patience, and please use caution when driving near the field crews.



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CRW ENGINEERING GROUP, LLC

Justin Keene, Project Manager
CRW Engineering Group, LLC
562-3252 • comments@crweng.com

www.ImageReflectionDrive.com

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- New road foundation
- New storm drain system
- Improved Street lighting
- New asphalt pavement
- Improved Pedestrian facilities

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Justin Keene, Project Manager, CRW Engineering Group, LLC
562-3252 • comments@crweng.com

www.ImageReflectionDrive.com

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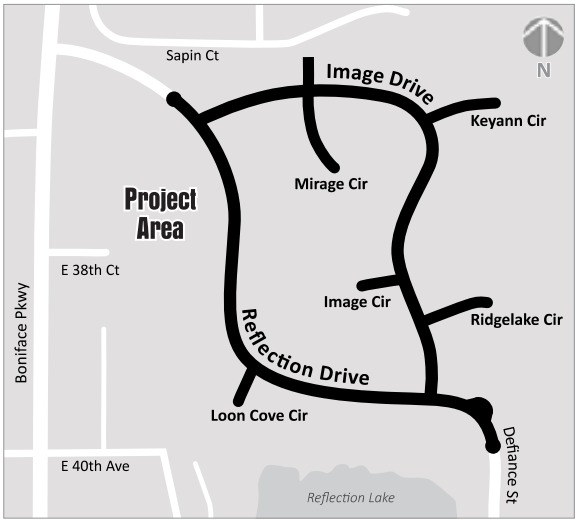
- Fill out a project questionnaire when it is mailed to you later this spring.

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

Image Drive / Reflection Drive
Area Road Reconstruction



MUNICIPALITY OF ANCHORAGE
PM&E

Justin Keene

From: Image/Reflection Area Road Reconstruction Project <cevans@crweng.ccsend.com> on behalf of Image/Reflection Area Road Reconstruction Project <comments@crweng.com>
Sent: Friday, May 27, 2016 12:48 PM
To: Justin Keene
Subject: Image/Reflection Road Reconstruction Questionnaire

Categories: Filed by Newforma

Help make this project a success!

Select the link below to share your feedback about the
Image Drive / Reflection Drive improvements in a 10 minute questionnaire.
We will use information gathered in the questionnaire to
inform the road improvement design.

Please complete the questionnaire by **June 15, 2016**.

We look forward to hearing from you!

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

Justin Keene, Project Manager
CRW Engineering Group LLC
562-3252 ● comments@crweng.com

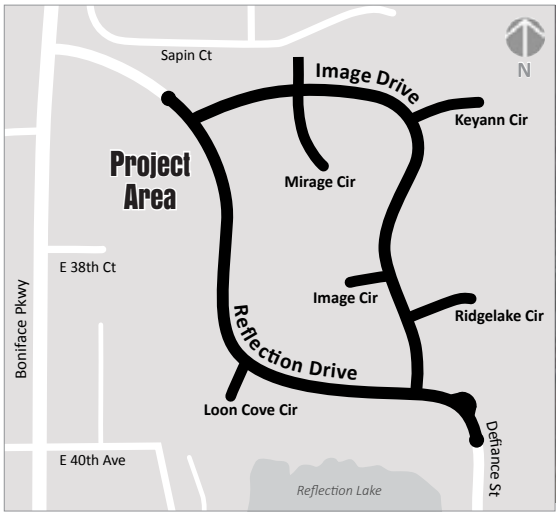
www.ImageReflectionDrive.com

PM&E Project # 14-50

Questionnaire

IMAGE DRIVE / REFLECTION DRIVE AREA ROAD RECONSTRUCTION

The Municipality of Anchorage (MOA) Project Management & Engineering (PM&E) Department is planning to upgrade the Image/Reflection Drive area (see map on right). Improvements are expected to include new road foundation, asphalt pavement, storm drain system, pedestrian facilities, and street lighting.



The project is funded through the draft Design Study Report (DSR) phase. No funding for construction has been received at this time.

Please take a moment to fill out this questionnaire and return it to CRW Engineering Group, LLC (CRW) by June 15, 2016. You can mail it in (just fold it, insert it in the included envelope and drop it in the mail), fax it to 561-2273, or e-mail your comments to comments@crweng.com. You can also fill out the questionnaire on-line by visiting the project website: www.imagereflectiondrive.com, or provide comments over the phone by calling Justin Keene at CRW, the Design Manager, at 562-3252.

Your comments are important to us. We will use this information to aid in designing the improvements.

Name: _____

Physical Address: _____

_____

Mailing Address (if different): _____

_____

E-Mail (optional): _____

Phone (optional): _____

1. **Can we send you future project updates via e-mail?** **YES / NO** (Please circle one)
2. **Do you own the property?** **YES / NO** (Please circle one)
3. **Have you ever experienced groundwater problems in your crawl space or basement?** **YES / NO** (Please circle one)

If yes, please explain. _____

_____

_____

4. **Do you have a foundation drain or sump pump?** **YES / NO** (Please circle one)

If yes, how many? _____

Where are they located? _____

Where does it drain? _____

How often does the pump run? (i.e. all year, spring, fall, after storms, etc.) _____

5. **Is your driveway heated or constructed with concrete?** **YES / NO** (Please circle one)

6. **Is there any special condition on your property that you feel the design team should be aware of in designing the project?** **YES / NO** (Please circle one)

If yes, please explain. _____

_____

7. **Are you aware of any drainage problems within the project area that need to be corrected?** **YES / NO** (Please circle one)

If yes, please explain. _____

_____

_____

8. **What are the top 3 things you would change about the streets within the project area?**

a) _____

b) _____

c) _____

9. **Do you have any concerns about speeding in your neighborhood?** **YES / NO** (Please circle one)

If yes, please explain. _____

_____

_____

10. **Do you think additional space in the roadway is required for on-street parking?** **YES / NO** (Please circle one)

If yes, please explain. _____

_____

_____

11. **Are you aware of any sight distance problems (i.e. trees or structures blocking traffic view) that may need to be corrected as part of the project?** **YES / NO** (Please circle one)

If yes, please explain. _____

_____

_____

12. **The existing sidewalks will likely be removed and replaced in their current locations. Do you feel there is a need to construct additional sidewalks in the neighborhood?** **YES / NO** (Please circle one)

If yes, at what locations. _____

_____

13. **Please include any other comments.** _____

_____

_____

WE APPRECIATE YOUR INPUT

Justin Keene

From: Image/Reflection Area Road Reconstruction Project <cevans@crweng.ccsend.com> on behalf of Image/Reflection Area Road Reconstruction Project <comments@crweng.com>
Sent: Monday, August 01, 2016 9:44 AM
To: Justin Keene
Subject: Image/Reflection Road Reconstruction Questionnaire Results

Categories: Filed by Newforma

In June, we solicited feedback from residents regarding improvements to the Image Drive / Reflection Drive Project Area. A summary of the questionnaire results can be found at the project website linked below.

Thank you for your feedback!

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

Justin Keene, Project Manager
CRW Engineering Group LLC
562-3252 ● comments@crweng.com

www.ImageReflectionDrive.com

Justin Keene

From: Image/Reflection Area Road Reconstruction Project <cevans@crweng.ccsend.com> on behalf of Image/Reflection Area Road Reconstruction Project <comments@crweng.com>
Sent: Wednesday, August 31, 2016 11:58 AM
To: Justin Keene
Subject: Image/Reflection Road - Additional Field Work

Categories: Filed by Newforma

August 2016 Project Update

Additional field work is planned near the intersection of Image Drive and Mirage Circle. Utility locate work is expected to start on August 31st with geotechnical drilling planned for September 8th.

Please use caution when driving near the field crews. Thank you!

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

Justin Keene, Project Manager
CRW Engineering Group LLC
562-3252 ● comments@crweng.com

www.ImageReflectionDrive.com

Meeting Summary

Date: October 18, 2016; 1:30 – 2:30 pm
Attendees: Jennifer Noffke, Russ Oswald (PM&E); Kris Langley (MOA Traffic); Paul VanLandingham (Street Maintenance); Justin Keene, Erica Jensen (CRW)
Reporter: Erica Jensen – CRW Engineering Group, LLC
Location: MOA PM&E Conference room B
Project: Image Drive/ Reflection Drive Area Reconstruction
Project No: 14-50 (CRW#10133.00)
Subject: Traffic Analysis and Proposed Roadway Design Elements

Discussion Items (also see attached meeting agenda for reference):

- **Traffic Calming**
  - Speed humps, or any vertical calming measure, is not ideal for fire and safety response vehicles
  - Maintenance is ok with speed humps and long-taper chokers (like recently installed on Meadow Street) but does not prefer speed tables.
  - Consider other measures, like chokers or on-street parking. Include these alternatives in the tech memo.

- **Typical Section**
  - Type 2 curb and gutter is proposed and appropriate for this already developed area with driveways in close proximity to each other. Type 1 curb and gutter to be used in some locations where topography allows and absence of driveways.
  - In general, sidewalks will be 5' wide and reconstructed where they are currently located.
    - At Mirage Circle (north), demolish this roadway. No access is proposed to the development north of this. This could be an ideal location for the anticipated required lift station. Do include a maintenance access pad/gate/bollards/etc.
  - Maintenance concerns:
    - Do not reduce snow storage. The only snow storage currently is the sidewalk/area directly behind the curb & gutter. This is ROW but perceived as homeowner's yard.
      - Sidewalks are easier for snow storage/plowing/hauling than grass.
      - Note: residential sidewalks are allowed to act as snow storage.
      - This area provides minimal snow storage and snow has to be hauled from the project site about every 3 snowfalls (~12"-15" of snow).
    - Do not include on-street parking in a designated, striped parking lane. The current situation with no striping and random on-street parking is ok.
      - No roadway striping, except for stop bars, is proposed
  - Image/Reflection Roadway width:
    - Even though MOA Traffic may entertain a reduced roadway section of 32' (back of curb to back of curb) versus the DCM standard of 33', PM&E prefers the roadway width be the DCM standard of 33'.

- **Next Steps: Develop Draft Tech memo to send out for review**
  - Image/Reflection Roadway width = 33’ (measured to back of curb)
  - Curb type = Type 2 rolled
  - Design speed and posted speed = 25 MPH (currently posted at 25 MPH)
  - Sidewalk width = 5’; remove and reconstruct at current locations, except:
    - Investigate new sidewalk on the east side of Image Drive, south of Ridgelake Circle.
    - Investigate new sidewalk on the north side of Image Drive, west of Mirage Circle (north).
    - Demolish Mirage Circle (north)
  - Include two alternatives:
    - 1 sidewalk (plus new additions in above bullet)
    - 2 sidewalks throughout project area. MOA needs to move towards DCM & ADA compliance.

Meeting Agenda

Date: October 18, 2016; 1:30 – 2:30 pm
Attendees: Jennifer Noffke, Russ Oswald (PM&E); Stephanie Mormilo (MOA Traffic); Paul VanLandingham (Street Maintenance); Justin Keene, Erica Jensen (CRW)
Reporter: Erica Jensen – CRW Engineering Group, LLC
Location: MOA PM&E Conference room A
Project: Image Drive/ Reflection Drive Area Reconstruction
Project No: 14-50 (CRW#10133.00)
Subject: Traffic Analysis and Proposed Roadway Design Elements

I. Purpose:

A. Get concurrence on, for incorporation into Draft Tech Memo:
   1. Roadway cross-section width and sidewalk(s) – main streets and cul-de-sacs
   2. Curb type
   3. Traffic calming

B. Draft Tech Memo will be sent out for review and comment.

II. Existing traffic conditions:

Roadway	AADT	85th Percentile speed (mph)	Year Data was taken
Image Drive	394	20	2014, 2016
Reflection Drive	450	23	2016

III. Existing roadway conditions:

A. ROW width:
   1. Main roads: 60'; current improvements are centered in the ROW
   2. Cul-de-sacs: 50'; current improvements are centered in the ROW
      1. Loon Cove Circle has a ROW width that varies up to 70' (before the circle)

B. Roadway widths (back of curb to back of curb):
   1. Image Dr. & Reflection Dr.: 33'
   2. Cul-de-Sacs:
      a. Mirage Cir. (north), Image Cir., & Ridgelake Cir.: 33'
      b. Mirage Cir. (south), Keyann Cir., & Loon Cove Cir.: 30'

C. Curb type: rolled (Type 2)

D. Driveways that access roadways (main roads only):
   1. Reflection Drive: 75 driveways
   2. Image Drive: 48 driveways

E. Sidewalk locations and width:
   1. Width = 4'
   2. Continuous along south/west sides of Reflection Dr. and Image Dr.

3. Continuous along both sides of Ridgelake Cir. cul-de-sac
4. Discontinuous at north/east sides or Reflection Dr. & Image Dr. and other cul-de-sacs

IV. Questionnaire summary results (traffic related):

A Do you have concerns about speeding? Yes (34), No (16)

B Do you think additional space is needed in the roadway for on-street parking? No (36), Yes (13)

C Do you feel there is a need to construct additional sidewalks? No (38), Yes (11)

V. Roadway traffic design (for main streets, unless otherwise noted)**:**

Design item	Design Value	Proposed value	Design value from
ADT	416	N/A	Traffic study
Roadway Classification	Secondary Street: Urban Residential	-	DCM Section 1.3 C
Street width[1]			
Main Street	33’	32’	DCM Table 1-6
Low volume Cul-de-Sac	31’	30’ – 31’	DCM Table 1-6
Driving lanes	2 – 11’ lanes	2 – 11’ lanes	DCM Table 1-6
Parking lanes	1 – 7’ lane	None	DCM Table 1-6
Shoulder width	3.5’	3.0’	DCM Table 1-6
Curb type	Type 1 (barrier)	Type 2 (rolled) [2]	DCM Figure 1-13
Design speed	25 mph	25 mph	DCM Table 1-6
Posted speed	30 mph	25 mph	DCM Section 1.5 E
Sidewalk location	Required both sides	Remove and replace in existing locations only [3]	AMC 21
Sidewalk width	5’	5’	DCM Figure 1-13
Traffic calming	-	Remove and replace speed humps in existing locations only[3]	

1. Street width is measured from back of curb to back of curb.
2. Where topography behind the back of curb and absence of driveways allows, Type 1 (barrier) is proposed.
3. See Existing Conditions Figure for locations of existing 4’ sidewalks and speed humps.

J:\Jobsdata\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\02 Meetings\GIS\Existing Conditions_Sidewalks.mxd

Legend

- Project Boundary
- Existing 4' Sidewalk
- Existing Creek
- Existing Speed Hump

0 125 250 500 Feet

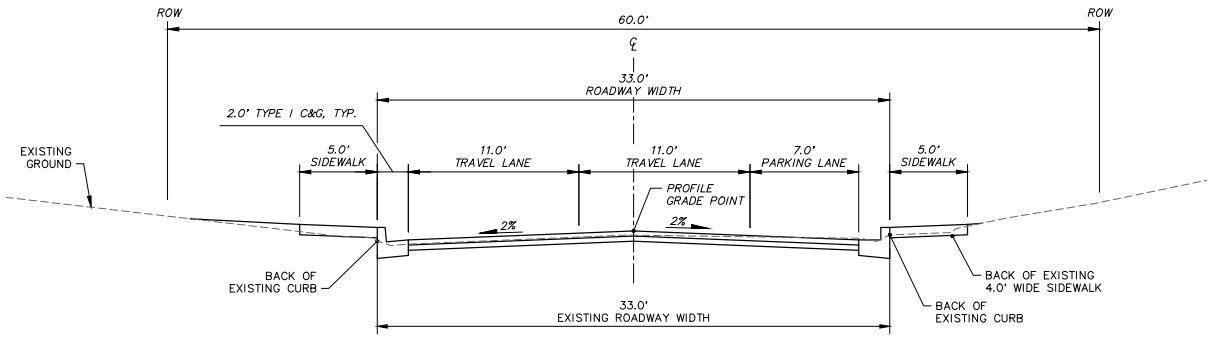
CRW ENGINEERING GROUP, LLC

N

Image Drive/Reflection Drive Area Road Reconstruction

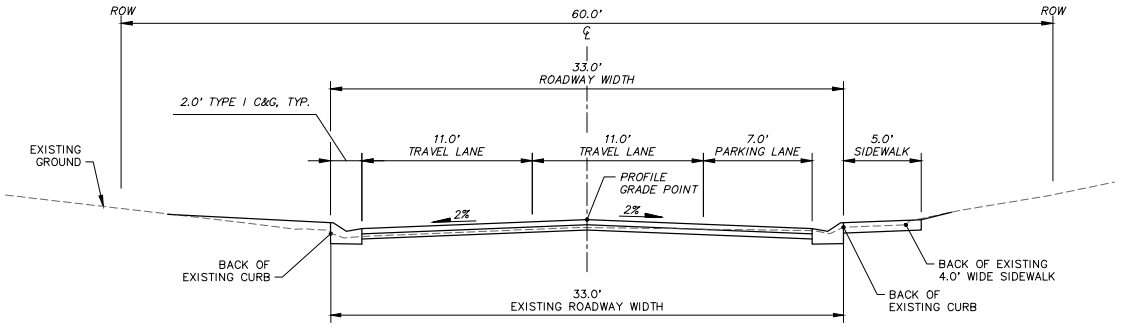
Existing Conditions:
Traffic volumes, speed hump locations, and sidewalk locations

PROJECT:	10133.00
STATUS:	Conceptual Design
DATE	October 2016
SCALE	See Scale Bar
FIGURE	1



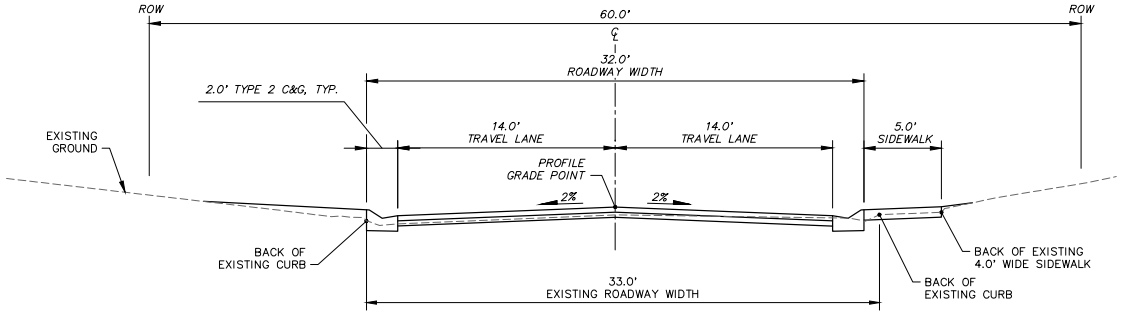
TYPICAL SECTION - DCM STANDARD
IMAGE DR. & REFLECTION DR.

1 NTS



TYPICAL SECTION - ALTERNATIVE OPTION 1
IMAGE DR. & REFLECTION DR.

2 NTS



TYPICAL SECTION - ALTERNATIVE OPTION 2
(SHOWN IN MEETING AGENDA TABLE)
IMAGE DR. & REFLECTION DR.

3 NTS

PROJECT: 10133.00
STATUS: CONCEPT

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

IMAGE/REFLECTION DR. AREA RECONSTRUCTION

TYPICAL ROADWAY SECTION OPTIONS

DATE: OCT 2016
SCALE: NTS
FIGURE: 1

File: J:\Jobsdata\10133.00 Image Reflection Area Reconstruction\00 CADD\02 Figures\02 Meetings\2016-10-13\Image_Typical Sections.dwg

Justin Keene

From: Image/Reflection Area Road Reconstruction Project <cevans@crweng.ccsend.com> on behalf of Image/Reflection Area Road Reconstruction Project <comments@crweng.com>
Sent: Monday, November 28, 2016 3:47 PM
To: Justin Keene
Subject: Image/Reflection Area Road Reconstruction Project Open House #1

Categories: Filed by Newforma

Please join us Thursday, December 8, for Open House #1 to discuss the preliminary concepts. Come share your comments and provide input to the project team.

The Municipality of Anchorage (MOA) is planning to upgrade the Image/ Reflection Drive area (see map on back). Improvements are expected to include:

- New road foundation
- New storm drain system
- Improved street lighting
- New asphalt pavement
- Improved pedestrian facilities

The MOA has contracted with CRW Engineering Group, LLC to provide preliminary engineering and design services. The project is currently funded through the Draft Design Study Report (DSR) phase. No funding for construction has been received at this time.

Open House #1

Thursday, December 8

5:30 PM - 7:30 PM

Stop by anytime!

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

Justin Keene, Project Manager
CRW Engineering Group LLC
562-3252 ● comments@crweng.com

Jennifer Noffke, Project Administrator
Municipality of Anchorage
343-8130 ● noffkejl@muni.org

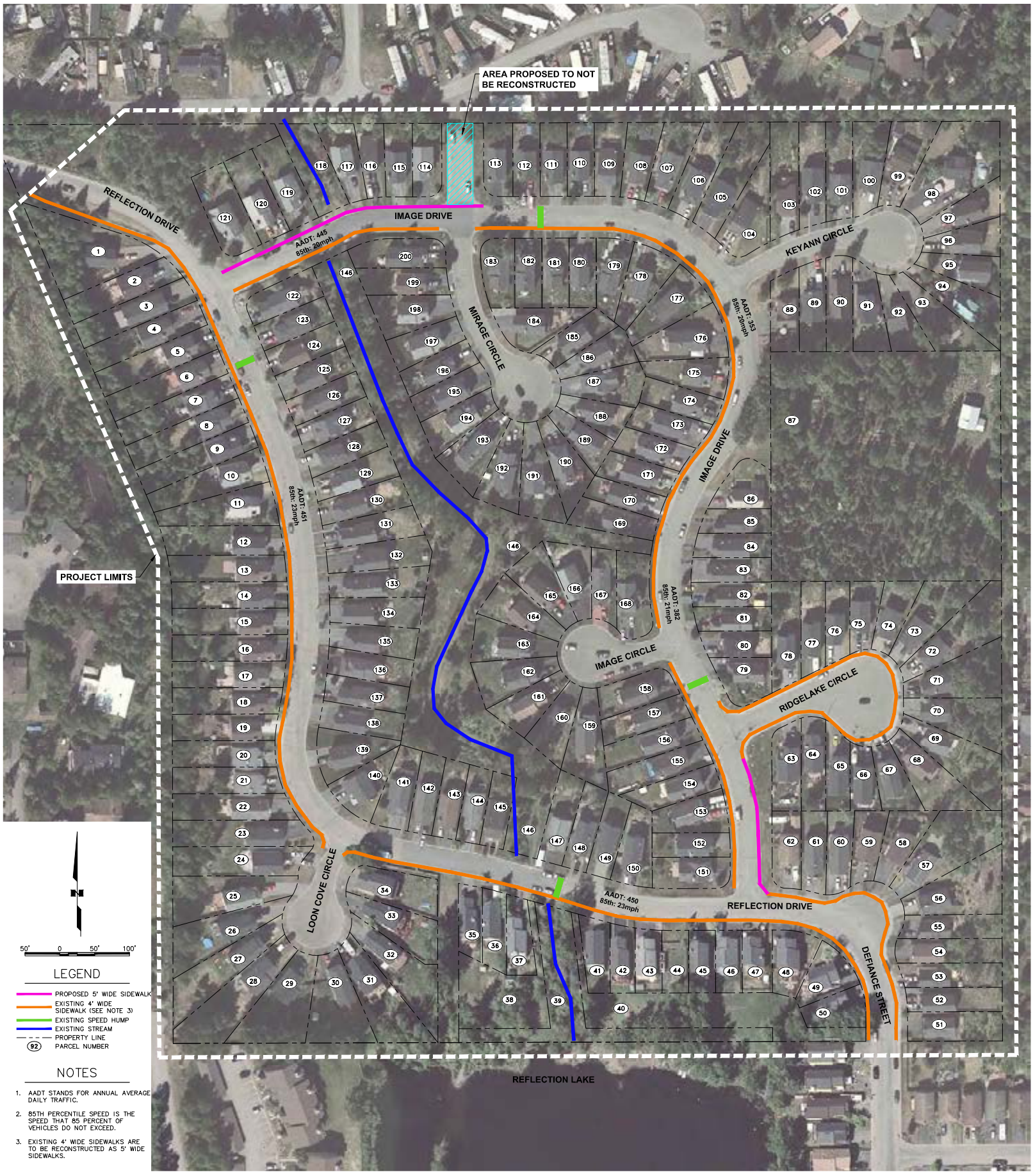
www.ImageReflectionDrive.com

Meeting Summary

Date: December 7, 2016; 7:30 – 8:30 pm
Presenter: Justin Keene (CRW)
Location: University Baptist Church
Project: Image Drive/ Reflection Drive Area Reconstruction
Project No: 14-50 (CRW#10133.00)
Subject: University Area Community Council (UACC) Meeting

Summary:

- Justin presented in front of the UACC with a display board showing the project limits (attached), below is a summary of the items presented.
  - Explained that this project came about due to failing storm drain pipes within the project limits which have resulted in heaving, cracking and failures to the road and sidewalk surface.
  - Explained that this project includes improvements to Image Drive and Reflection Drive as well as all the cul-de-sacs within the project limits.
  - Provided a quick summary of the expected improvements: new road foundation, new asphalt pavement, new storm drain system, improved pedestrian facilities and improved street lighting.
  - Explained work done so far: topgraphic survey, geotechnical analysis, mailed out questionnaire to residents and developed conceptual cross section.
  - Discussed that this project is currently funded through the Draft Design Study Report, no funding for design or construction has been received at this time.
  - Invited everyone to the Open House #1 meeting tomorrow night from 5:30 -7:30 pm at MOA Planning and Development Center located south of Tudor Road on Elmore Road. Explained that we would appreciate comments and input. I had some Open House #1 invites that I offered to the UACC that shows the location of the meeting.
  - I explained that the project has a website: www.ImageReflectionDrive.com that the public can see the latest project news and provide comments and will be updated throughout the project.
  - Also passed around a project update sign-up sheet for folks to get on the project Constant Contact e-mail list, one person signed up.
- Justin then opened it up to questions and he answered a few questions from the UACC members.


AREA PROPOSED TO NOT BE RECONSTRUCTED
REFLECTION DRIVE
IMAGE DRIVE
AADT: 445
85th: 20mph
KEYANN CIRCLE
MIRAGE CIRCLE
AADT: 353
85th: 20mph
IMAGE DRIVE
AADT: 451
85th: 23mph
PROJECT LIMITS
AADT: 382
85th: 21mph
IMAGE CIRCLE
RIDGELAKE CIRCLE
LOON COVE CIRCLE
AADT: 450
85th: 23mph
REFLECTION DRIVE
DEFIANCE STREET
REFLECTION LAKE
50' 0 50' 100'
LEGEND
PROPOSED 5' WIDE SIDEWALK
EXISTING 4' WIDE SIDEWALK (SEE NOTE 3)
EXISTING SPEED HUMP
EXISTING STREAM
PROPERTY LINE
92 PARCEL NUMBER
NOTES
1. AADT STANDS FOR ANNUAL AVERAGE DAILY TRAFFIC.
2. 85TH PERCENTILE SPEED IS THE SPEED THAT 85 PERCENT OF VEHICLES DO NOT EXCEED.
3. EXISTING 4' WIDE SIDEWALKS ARE TO BE RECONSTRUCTED AS 5' WIDE SIDEWALKS.

UNIVERSITY AREA COMMUNITY COUNCIL (UACC)

Wednesday December 7, 2016, 7:00-9:00 P.M.

LOCATION:
University Baptist Church
4313 Wright Street (corner of Tudor and Wright St.)

1. Opening (7:00 P.M.)

    A. Welcome & Introductions (5 min.)

2. Approval of October and November Minutes – see attachments (5 min.)
3. Additions to and Approval of December's Agenda (2 min.)
4. Informational Reports/Reports from Public Servants/Elected Officials (5 min. each)

    A. UACC Board Report (5 min.)

    B. FCC Representative Report (5 min.)

5. Solicitation of nominations for UACC officers for 2017 (2 min.)
6. New Business (7:50 P.M.)

    A. Rosemary/Arca Water Main Improvement Project – James Armstrong, Project Manager, Anchorage Water & Wastewater Utility (15 min.)

    B. MOA's Image Drive / Reflection Drive Area Road Reconstruction Project and Invitation to 12/8 Open House - Justin Keene, Project Manager, CRW Engineering Group (10 min.)

7. Adjournment no later than 8:55 PM

"The purpose of the council shall be to improve communications between the citizens of the community and all entities, which may affect it, to encourage community involvement of all citizens, and to respond to local government proposals submitted to the council."

– Bylaws of the University Area Community Council –

PM&E

The Municipality of Anchorage (MOA) is planning to upgrade the Image/ Reflection Drive area (see map on back). Improvements are expected to include:

- New road foundation
- New storm drain system
- Improved street lighting
- New asphalt pavement
- Improved pedestrian facilities

The MOA has contracted with CRW Engineering Group, LLC to provide preliminary engineering and design services. The project is currently funded through the Draft Design Study Report (DSR) phase. No funding for construction has been received at this time.

Please join us Thursday, December 8, for Open House #1 to discuss the preliminary concepts. Come share your comments and provide input to the project team.

www.ImageReflectionDrive.com

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

Justin Keene, Project Manager, CRW Engineering Group, LLC • 562-3252 • comments@crweng.com
Jennifer Noffke, Project Administrator, MOA • 343-8130 • noffkejl@muni.org

OPEN HOUSE #1

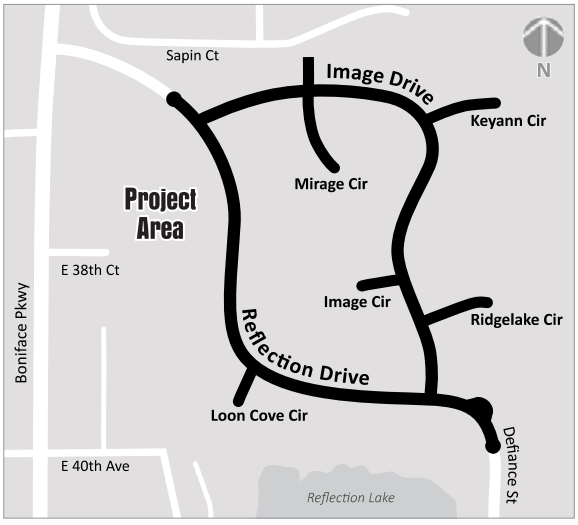
Thursday, December 8
5:30 PM — 7:30 PM
Stop by anytime!

Municipality of Anchorage
PLANNING & DEVELOPMENT CENTER

4700 Elmore Road
1st Floor Training Room

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

Image Drive / Reflection Drive
Area Road Reconstruction



MUNICIPALITY OF ANCHORAGE
PM&E

Open House Comment Summary

Date:	December 8, 2016; 5:30 – 7:30 pm
Attendees:	See sign-in sheet
Reporter:	Erica Jensen – CRW Engineering Group, LLC
Location:	Municipality of Anchorage Planning & Development Center 1st Floor Training
Project:	Image Drive/Reflection Drive Area Road Reconstruction
Project No:	14-50 (CRW#10133.00)
Subject:	Open House #1 Summary Report

Open House Summary

Open House #1 for the Image Drive/Reflection Drive Area Road Reconstruction project was held on Thursday, December 8th from 5:30 – 7:30 pm at the Municipality of Anchorage Planning & Development Center 1st Floor Training room located near the project area. The Open House did not have a formal presentation but was rather an open format style where attendees could stop by anytime and ask questions, provide comments, and obtain feedback.

Attendees were greeted and asked to sign-in upon arrival. Project team members were available to answer questions and discuss any concerns the attendee may have. A set of informational graphics provided general project information including:

- Project Timeline (indicating the project progression and where we currently are in the process)
- Summary of Proposed Improvements
- Questionnaire Responses – a summary of responses to the questionnaire mailed to residents in June, 2016
- Typical Conceptual Cross Section for Image Drive and Reflection Drive
- Project Area Maps depicting the existing conditions over an aerial image – one map showed the overall project limits and two additional maps each showed one half of the project limits. These maps were laid out on tables and attendees were encouraged to provide comments directly on the maps.

A copy of the graphics is included in this summary report. The graphics were staffed by the project team and attendees were encouraged to provide feedback to the project team. Notes were taken directly on the Project Area Maps to accurately document the attendee's concern and location of the concern. A summary of the comments obtained from the maps is included in this report.

Open House Advertising

Community Council: The project Open House was announced by a member of the project team at the University Area Community Council on Wednesday, December 7th.

Mailing: A mailer invitation to the Open House was sent by postcard via the USPS mail on November 28th.

Web: The project Open House details, including the date, time, and location, were posted on the project website by November 23rd.

Open House Comment Summary

E-mail: Two Constant Contact emails were sent to the project email list announcing the Open House:

1. Announce Open House (11-28-2016)
2. Reminder for Open House (12-6-2016)

Open House Follow-up

Following the Open House, the graphical displays were made available on the project website. A “thank you” email was sent to the project email list, including those attendees who provided their email at the Open House.

Attachments

1. Comments summary
2. Sign-in sheet
3. Graphical displays and maps
4. Advertisements (mailer, emails)

Open House Comment Summary

Date: December 8, 2016; 5:30 – 7:30 pm
Project: Image Drive/Reflection Drive Area Road Reconstruction
Project No: 14-50 (CRW#10133.00)
Subject: Open House #1 Comments Summary

Source	Comment
Area map #1	People park along the inside of the curve at Defiance/Reflection. This is an undesirable location for people to park.
Area map #1	Recommend speed humps on Reflection both before and after the intersection with Loon Cove. This is a blind corner and there are speeding issues.
Area map #1	Happy with existing sidewalks (does not support the addition of new sidewalks)
Area map #1	There is a parking issue on Reflection Drive, just south of the (north) intersection with Image Drive. Consider traffic calming
Area map #2	In 2013, there was water in the crawl space of Parcel 182 and his neighbors (Parcels 180, 181, 110, 111, 112, and 113) west of Mirage Circle. They installed sumps and haven't had flooding since, but the sumps do run.
Area map #2	The fence between Mirage Circle north and the northern development is failing. Who is responsible for this fence?
Area map #2	People park in the dead-end of Mirage Circle north. Don't remove parking.
Area map #2	There are drainage issues along the back side of the houses which are on the west side of Reflection Drive.
Area map #2	Concern that new development will cause more drainage issues to the houses mentioned in comment above. Suggest reviewing area in the spring during break up.
Area map #2	Suggest adding more catch basins along Reflection Drive.
Area map #2	Parcel 134 has neither a sump pump nor a foundation drain. Parcel 134's driveway was constructed with several feet of gravel, insulation, and fabric. There is a "sink area" in the roadway just west of the Parcel 134 driveway.
Area map #2	A long-time resident said that many of the houses along the west side of Reflection Drive (Parcels ~6 thru ~18) have sump pumps in their crawl spaces that discharge to their side yards. The groundwater could be coming from the hill to the west.
Area map #2	The driveway for Parcel 14 was constructed with insulation.
Area map #2	Possible drainage issues in the back yards of the homes west of Reflection Drive.
Area map #3	Parcels 135 and 136 do not have drainage issues
Area map #3	Speeding is an issue
Area map #3	To his knowledge, all the homeowners on Loon Cove Circle has sump pump(s)

Open House Comment Summary

Area map #3	I would like to see sidewalks on Loon Cove Circle
Area map #3	There is a “ditch” that runs from the road above Loon Cove Circle to Reflection Lake along the back of the properties, but it is filled in and doesn’t function. Snow is stored at the road above the cul-de-sac and the drainage floods our backyards.
Area map #3	The homeowner for Parcel 35 considers the ROW west of her house as “her yard”
Area map #3	There is no HOA (at least for Loon Cove Circle residents)

Image Drive / Reflection Drive Area Road Upgrade
Open House #1 Sign-In

Date: Thursday December 8, 2016
Location: Municipality of Anchorage Planning and Development Center

Name	Mailing Address	Phone	E-mail Address	Add to E-Mail List?
Jennifer Noffke	[redacted]			Y
Erica Jensen				Y
Will Massey				com Y
Brandon Wood				
Greta Little				N
Shawn Little				
Pete Peterson				Y
Marc Fruncer				Y
Forrest Dunbar				
[illegible]				Y
MARK NALTY				N

philnalty1984@gmail.com