4.8—Existing conditions photos

“Ball Field” Creek stream approaching highway culvert

“Ball Field” Creek highway culvert inlet

“Ball Field” Creek highway culvert

“Ball Field” Creek highway culvert outlet

“Ball Field” Creek typical channel condition

5 MP 103.0 - Indian Creek

5.1 Introduction

Indian Creek is located near Milepost 102.9. The creek crosses the highway through a bridge comprised of two piers and sloping abutments. The stream passes between the two piers which are spaced at 54-ft. The distance between the abutment toes is 106-ft measured along the existing highway alignment.

Improvements associated with existing alignment and frontage road alternatives including plan and profile are still in the development process. Therefore, details of bridge modifications or replacement for the Highway or the Frontage Road are not known. As bridges require detailed analysis and design it is not possible to provide more than general information at this time. Simply based on the width of Indian Creek, a bridge would be required for any crossings of Indian Creek. Based on the satisfactory performance of the existing highway bridge, it is likely that a bridge similar in span to the existing bridge would be necessary.

Indian Creek is listed in the ADF&G Anadromous Waters Catalog AWC# 247-60-10290, and supports natural runs of Chinook and pink salmon. Coho salmon are also present in this system, but it is thought these fish are likely strays from Bird Creek (Dan Bosch, ADF&G, agency meeting August 1, 2006).

5.2 Hydraulic History

The bridge is approximately 40-ft wide. Project survey data collected by DOWL HKM surveyors includes cross sections above and below the bridge abutments with a spacing of 85-ft with thalweg elevations equal to 15.94-ft and 14.44-ft, respectively. The top of the abutments at the retaining wall for the bridge approach were surveyed with elevations about equal to 32-ft. The average stream slope through the bridge and immediately downstream is about 0.015-ft/ft. From about 100-ft downstream of the bridge and towards the ARRC embankment the stream steepens to 0.034-ft/ft.

Tidal

Tidal influence is not believed to extend upstream to the bridge as described here. No conversion was located by the DOWL HKM surveyors from the project survey vertical datum of NGS 1967/68 to tidal vertical datum based on MLLW. Therefore, field indicators were used to estimate a representative high tide elevation. Riparian vegetation including willows and alder were noted along the edge of stream bank immediately upstream of the ARRC culvert suggesting that salt water influence does not extend this far upstream. Backwater effects from high tides may extend further upstream than signatures of salt water presence may indicate. An estimate of frequently occurring stream levels was obtained from the observed stain/rust line on the ARRC culverts noted at a height of about 0.6 times the rise. This elevation is approximately 12.3-ft based on

culvert invert and crown elevations. Making a gross assumption that this represents a frequently occurring high tide influenced flow condition, a model run was executed with a 12.3-ft downstream water surface as a boundary condition. With this assumption, the water surface elevations between this model run and a model run using a normal depth downstream boundary condition (i.e. low tide) matched at a cross section 38-ft upstream of the ARRC culverts.

Non-tidal

Stream hydraulics for existing conditions were modeled with HEC-RAS and are summarized in the Hydraulics Appendix.

Indian Creek is not gauged and no historical flood data were identified for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. This reach of stream appears as a Zone A (no base flood elevations determined) designation on the FEMA Flood Insurance Rate Map (FEMA FIRM 0200052203 C, Revised July 2002).

Navigation

The creek is approximately 35- to 45-ft wide by 2- to 3-ft deep and flows at slopes of 0.015- to 0.034-ft/ft. The stream is too steep, shallow and fast for navigation. There is no navigation currently or possible in the future. The stream has enough vegetation encroachments combined with shallow flows that white water recreation would not be safe or feasible.

Confluences

The stream flows for 230-ft before passing through three culverts through the ARRC embankment then discharging onto tide flats of Turnagain Arm. No upstream confluences other than small tributaries were observed in the vicinity or noted on the available mapping. Therefore, no impacts to confluences are expected.

Mining

There is no evidence that mining occurs on this stream.

Debris and icing Problems

Gravel and cobble are transported by Indian Creek. Woody debris comprised primarily of sticks and branches up to slash sized material is transported along Indian Creek. Flow is too shallow for transport of large trees. Icing conditions are not known but would be expected to include aufeis, ice dams and jams. The bridge span and free board appear sufficiently large to pass sediment, debris and ice.

Bed Load

Gravel and small cobble are transported along Indian Creek. A depositional gravel bar is located under the bridge through a locally wider and flatter section of stream. A pebble count of surficial substrate on this bar indicates particles up to 128-mm in size with a D50 (50-percent of the particles, by count, are smaller) equal to 22.6-mm. The gravel bar is slightly armored from fine particles being winnowed from the surface by stream flows

leaving a coarser layer of sediment. Other reaches of Indian Creek that are narrower or steeper tend to be transport reaches with this size of sediment absent.

Geomorphic Conditions

Geomorphic conditions are summarized in the Fish Habitat Inventory prepared by Inter-Fluve (Inter-Fluve, 2007) and recounted in the remainder of this section.

From observations and simple hand tape measurements, this creek was surveyed starting from a point 280-ft upstream of the north edge of the Seward Highway bridge and proceeding downstream. At the upstream end of the survey, the stream is a single riffle with an average width of 35-ft. The stream flows over a rocky substrate and through a mature forest of birch, cottonwood, willow and alder. 260-ft upstream of the bridge, the creek splits into two channels and flows around a forested island. The east channel is composed of a single riffle reach with a fairly uniform width of 15-ft. The length of this reach of the stream is 250-ft. The western branch of the stream is composed of a series of riffles and pools. The first pool begins at the upstream end of the island and is created in part by a small log jam. The pool is 27-ft in length and 15-ft in width. The stream then flows through a 95-ft riffle reach before another log jam slows the flow and has created a pool. This pool is 23-ft long and averages 10-ft wide. There is a 2-ft high waterfall at the log jam.

The riffle that starts at the pool outlet joins with the east branch riffle and continues downstream under the highway bridge. On the western side, 35-ft downstream of the bike path bridge, there is a 45-ft long, 6-ft wide backwater pool. The bank along the pool is undercut, and the willow trees along the edge are overhanging the stream. The riffle reach continues downstream, sweeping around a broad corner, with a small branch splitting around a vegetated island just downstream of the backwater pool. Throughout the riffle reach the stream substrate is composed of small cobbles with larger rocks providing structure within the stream. The average width of the riffle section is 30-ft and the banks remain forested with alder, cottonwood and willow. The next downstream reach is composed of a 30-ft long glide, averaging 25-ft in width. The southern bank of the stream along the glide is eroded, with many of the trees lying nearly horizontal and reaching full width across the stream. The remaining reach to the three railroad crossing culverts is all riffle and averages 15-ft in width. In this reach, the average substrate size is larger than immediately upstream and includes rocks that are part of the fill for the adjacent railroad tracks. The stream bends 90º into the three 6-ft diameter culverts that cross under the railroad. These pipes are all in poor condition, with substantial rusted sections, especially at the outlet ends. Downstream of the culverts the stream flows through a rocky intertidal reach that is composed of a riffle during low tide.

Fish Utilization

Indian Creek is listed in the ADF&G Anadromous Waters Catalog AWC# 247-60-10290, and supports natural runs of Chinook and pink salmon. Coho salmon are also present in this system, but it is thought these fish are likely strays from Bird Creek (Dan Bosch, ADF&G, agency meeting August 1, 2006).

Although there has not been a study to determine the specific timing of the outmigration of Chinook smolts, it is likely that this occurs in May and June each year (Dan Bosch, ADF&G, personal communication, January 16, 2007). Pink salmon fry typically emerge in early to late spring and reside in fresh water only a short time before outmigrating to the ocean. There is not believed to be much coho rearing habitat in this system, although the pools observed during this survey are characteristic of productive coho habitat and could provide adequate rearing areas.

Currently the railroad culverts are perched during low tide, and the combination of rock placement at the outlet and sharp, jagged, decomposed metal make fish access during low tide hazardous, if not highly unlikely. At the time of the survey the tide was low and a substantial number of pink salmon were milling just below the pipes. There were no fish observed attempting to leap the outlet drops. At high tide the pipes would not serve as a barrier to fish passage.

5.3 Hydrology

As noted in the Hydrology section, Indian Creek has a contributing basin drainage area of approximately 17.5-square miles. Elevations range from sea level to about 5,500-ft with about 28% forest cover. Runoff timing in these basins is expected to be similar to that of the adjacent Ship Creek to the north, where snowmelt results in peak flows from May through July.

As shown in Table 2, peak flow estimates using regional regression equations ranged from about 260-cfs for the 2-year event to 960-cfs for the 100-year flood. As shown in Table 6, the fish passage design flow, Q_{fish} is estimated to be 191-cfs. There is no local input to report for this basin.

Backwater analysis has been completed for existing conditions and is reported in the Hydraulic Appendix.

Minor scour was noted along the right (looking downstream) pier where the active flow impinges on the pier mid-section and downstream end. Bridge designs will require locating and configuring piers to minimize scour potential and providing adequate scour protection.

5.4 Hydraulic Design

To be completed at a later phase when design alignment and profile are determined.

5.5 23 CFR

This reach of stream appears as a Zone A (no base flood elevations determined) designation on the FEMA Flood Insurance Rate Map (FEMA FIRM 0200052203 C, Revised July 2002). The proposed action will be determined at a later phase but is anticipated to include improvements to the existing bridge and addition of a bridge for the

frontage road. Back water effects are to be determined at a later phase in conjunction with design of bridge improvements.

5.6 Conclusion

A summary of existing conditions is provided. Details of the alternatives alignments and profiles are in development. Given the width of Indian Creek, stream crossing improvements are anticipated to require bridges. Hydraulic analysis will be completed at a later phase as the details of the alignment alternatives are developed.

5.7 Riprap

No riprap is proposed at this phase. Riprap may be required as part of the scour protection measures for bridge improvements.

5.8 Existing conditions photos

Photos of existing conditions follow on the next three pages.

5.8—Existing conditions photos

Indian Creek—looking upstream from ARRC culvert inlets

Indian Creek—looking upstream towards highway bridge

Indian Creek—looking upstream at highway bridge

Indian Creek—looking downstream at gravel bar at highway bridge

Indian Creek—looking downstream through highway bridge

Indian Creek—looking upstream from highway bridge

6 MP 103.5 - “Subdivision” Creek

6.1 Introduction

The unnamed stream crossing Seward Highway near milepost (MP) 103.5 flows from a subdivision area near the Indian House Restaurant and has been nicknamed “Subdivision” Creek. The improvements associated with the existing alignment alternative are assumed to have no change in footprint. The frontage road will be to the north, or hill slope side, of the existing highway and is assumed to have a road width of 30-ft. The existing highway is about equal in elevation to the surrounding topography on the uphill side. Therefore, at this preliminary phase, the embankment for the frontage road is assumed to be at or near existing grade and will require a culvert up to 45-ft in length.

The existing stream alignment flows through two driveway embankments uphill of the highway via single 18- inch diameter CMP culverts. The stream then flows for about 43-ft through a 2-ft wide by 1-ft deep straightened channel reach parallel to the highway. Based on project aerial topography of adjacent land surface, the stream discharges from the hill slope and approaches the driveways through a segment about 210-ft long at about 0.024-ft/ft slope. The average slope from the outlet of the upper driveway culvert to the inlet of the highway culvert is 0.036-ft/ft. The channel turns 90-degrees at the inlet of a 24-inch diameter CMP to cross through the highway embankment. Based on project survey data collected by DOWL HKM surveyors, the Seward Highway crossing culvert is 79-ft long. The invert elevations at the inlet and outlet are 36.05-ft and 28.09-ft, respectively, for a slope equal to 10.1-percent. Surveyed elevations along both edges of highway bracketing the inlet and outlet of the pipe range from 42.08- to 42.96-ft. Upon exiting the culvert, the channel turns 90-degrees to flow for about 64-ft through a 2.5-ft wide by 1-ft deep straightened channel reach at 0.021-ft/ft slope between the highway and the ARRC. The channel then turns 90-degrees to enter a 36-inch diameter culvert through the ARRC embankment. An additional 36-inch diameter CMP culvert through the highway embankment is tributary to this stream immediately opposite the inlet to the ARRC culvert; no flow was noted through this pipe during the field investigation. The stream exits the ARRC culvert aligned with a 3-ft wide by 1-ft deep stream section that flows for about 122-ft through a thinned forest area. The stream exits the forested area at the Turnagain Arm shore bank where the stream cascades off a 6-ft high waterfall. The average slope of the channel below the ARRC is 0.033-ft/ft along the upper half before steepening to 0.074-ft/ft along the approach to the waterfall. At the base of the waterfall, the stream flows across the tide flats, which are sloped at about 10-percent, and continues as shallow sheet flow until entering the Turnagain Arm. Based on the height of the waterfall, the slope of the near shore area, and the lack of any pool at the base of the waterfall, there appears to be no upstream salmonid passage.

Dolly Varden have been trapped by ADNR OHMP biologists in the stream between the ARRC and highway culverts. OHMP has requested that fish passage be provided

through new culverts (Email from Ed Weiss, DNR to K. Hansen, DOWL HKM June 29, 2006). The stream is not currently listed in the ADF&G Anadromous Waters Catalog.

At this preliminary, alternatives analysis stage new culverts were designed to pass the design flood within HDM criteria (HW/D < 1.5). The existing 24-inch CMP at 10-percent slope is impassable by fish. Interim design iterations failed to meet FishXing Tier 2 methods and only met FISHPASS methods through use of baffles with a height equal to 0.15 times the diameter. Therefore, fish passage design through culverts was based on Tier 1 methods in conjunction with stream channel relocation. This project will replace the existing pipe with a larger 4'-9" by 3'-2" pipe arch, countersunk to 1-ft depth, to convey flood flows and provide fish passage. It is assumed that the driveway culverts for this stream will be replaced by the frontage road. In addition to new culverts, the stream channel is proposed to be relocated and placed on a new profile in order to remove the barrier imposed by the existing 10-percent pipe slope.

6.2 Hydraulic History

From the site visit conducted in August 2006, a rapid assessment by visual inspection and simple measurements was completed. The existing culvert is a 24-inch CMP with no stream substrate material in the bottom of the pipe. The bottom of the pipe is rusted with a stain line to 1.8-ft depth at the inlet. Flow was observed to a depth 0.3-ft to 0.5-ft at the inlet and outlet, respectively. The outlet is slightly squashed. A follow up survey of culvert inlet/outlet and stream profile and cross section were completed at a later date by DOWL HKM surveyors. From the site survey, the existing pipe is approximately 79-ft long at 0.1007-ft/ft slope.

Tidal

No tidal influence extends to this elevation or location of stream. The stream crosses the Seward Highway through a 24-inch diameter CMP culvert with invert elevations at the inlet and outlet of 36.05-ft and 28.09-ft, respectively. Upon exiting the highway culvert the stream flows for 64-ft, through an ARRC culvert, flowing another 122-ft before discharging over a 6-ft waterfall to enter the Turnagain Arm tidal area. The crest of the waterfall is at elevation 21.5-ft (NGS 1967/68). The culvert and stream at the highway is above tidal influence from Turnagain Arm.

Non-tidal

This stream is relatively small – it passes through 18-inch diameter CMP culverts through two driveways prior to entering the DOT&PF right of way and has an active channel about 2- to 3-ft wide by 1-ft deep. No historical flood data were identified for this tributary. Magnitude and water surface elevations for the flood of record are not known. High water marks for large flood events were not evident. No Flood Insurance Studies boundaries are mapped for this tributary (FEMA FIRM, 1987).

Navigation

The creek is approximately 2- to 3-ft wide by 1-ft deep and is too small for navigation. There is no navigation currently or possible in the future.

Confluences

The stream flows for 64-ft before passing through the ARRC embankment then flowing for an additional 122-ft before discharging over a 6-ft high waterfall to enter the Turnagain Arm. A confluence with a tributary is noted on the project mapping about 85-ft upstream of the upper driveway culvert inlet; 135-ft upstream of the highway culvert inlet. This tributary appears for a length of 170-ft of the project topographic mapping running up a steep slope to drain a trail. This tributary is a small feature. Therefore, no impacts to confluences are expected.

Mining

There is no evidence that mining occurs on this stream.

Debris and icing Problems

No debris beyond small gravel, grasses and small sticks were observed in the channel or culverts. Thaw pipes were noted on a number of culverts through the project corridor. The proposed pipe will have a larger open conveyance area than the existing 24-inch CMP and exceeds the open area of the 36-inch diameter minimum for icing conditions.

Bed Load

Bed load is limited to small gravel or smaller substrate. Volume of bed load is small. Areas of deposition are limited in area and volume. The stream and culvert system appears to be able to pass the bed load with no evidence of excessive deposition or erosion.

Geomorphic Conditions

Geomorphic conditions are summarized in the Fish Habitat Inventory prepared by Inter-Fluve (Inter-Fluve, 2007) and recounted in the remainder of this section. From observations and simple hand tape measurements, this is a mountain fed stream that passes through a series of driveway culverts before it reaches the highway. Immediately upstream of the highway culvert there is a 40-ft riffle section running parallel to the highway. This riffle has an average width of 2-ft and follows the toe of the embankment. It is well vegetated with grasses and has gravel substrate. Upstream of this riffle, the stream passes through two culverts separated by another short riffle section. Above the upper culvert the stream flows through a channel with a relatively low width-to-depth ratio and is overgrown with dense riparian vegetation.

Between the outlet of the highway culvert and the railroad culvert the stream consists of an open riffle section with minimal vegetative cover. Downstream of the railroad crossing culvert the stream is composed of a 120-ft glide section of uniform grade. In this section, the stream is entrenched, the substrate is primarily gravel, and there is a substantial quantity of small woody debris present. The riparian vegetation is primarily grasses, with some scattered cottonwood forest. This glide reach terminates in a 6-ft waterfall at the upper edge of the intertidal zone. Downstream of the waterfall the stream spreads out broadly over the 90-ft wide section of gravel beach and consolidates into a more defined channel in the silt substrate of the lower intertidal zone as observed at a relatively low tide.

Environmental - Fish Utilization

Although the waterfall is a fish passage barrier, trapping conducted by DNR during the summer of 2006 found resident Dolly Varden present between the railroad culvert inlet and the highway (Ed Weiss, DNR 6/29/2006 email to K. Hansen, DOWL HKM). DNR has requested that fish passage be provided through new culverts. At this time, the stream is not listed in the ADF&G Anadromous Waters Catalog.

6.3 Hydrology

As noted in the Hydrology Section, this stream (Trib 1), has a contributing basin drainage area of approximately 0.6 square miles, is relatively low in elevation, and is densely forested (69%). Some residential development is located in the lower elevations. This watershed is expected to exhibit a rain-dominated runoff regime, with peak flows occurring in September and October when rainfall amounts are greatest.

There is no known gage information for this stream. As shown in Table 2, peak flow estimates using regional regression equations ranged from 11-cfs for the 2-year event to 60-cfs for the 100-year flood. As shown in Table 6, the fish passage design flow, Q_{fish}, is estimated to be 8.6-cfs. There is no local input to report for this basin.

Backwater analysis has been completed and is reported in the Hydraulic Design Section and appendix.

Scour was not observed for the existing stream and culverts. The proposed culverts are larger in size and at a flatter gradient and would have lower energy and scour potential. At this preliminary stage no detailed scour analysis has been conducted.

6.4 Hydraulic Design

At this phase, preliminary design was completed in support of the Preliminary Engineering Report. More detailed designs will be prepared and documented during subsequent phases.

A 4’9”x3’2” pipe arch is recommended as the replacement at the frontage road and highway crossings. As described above, the Tier 1 (stream simulation) method was selected for design of fish passage through the new culverts. This size pipe will satisfy requirements of the Tier 1 design method for fish passage as stated in the MOA. This culvert will provide sufficient span to accommodate the average of channel widths surveyed upstream and downstream of the culvert of about 4-ft and 6-ft, respectively.

The existing culvert through the highway embankment is at a 10-percent slope and is a barrier to fish passage. To remove this barrier, the slope of the existing highway culvert needs to be reduced. This will require modifications to the stream alignment and profile as shown in Sheet 4 (Appendix 1). Based on average slopes along the existing channel of 0.036-ft/ft above the highway culvert and 0.033-ft/ft below the ARRC, a target design slope of 0.043-ft/ft was selected for the profile along the channel realignment and culvert crossing. This slope is premised on Tier 1 methods of design slopes being within 1-

percent of existing slopes. The alignment limits the length of channel required to match to existing grade at the upstream and downstream ends. In order to maintain conveyance capacity along the channel paralleling the ARRC embankment, the new highway culvert location is moved to the west about 45-ft to be closer to the ARRC culvert inlet. Along the uphill side of the highway, the stream is extended toward the west to the new inlet. The frontage road culvert outlet is near the existing outlet of the downstream driveway culvert. From the frontage road inlet, the channel realignment then extends upstream until it intercepts the existing stream profile approximately 100-ft upstream of the upstream inlet. It must be noted that this alignment is expected to extend beyond the existing DOT&PF right of way.

Stream substrate will be placed along the bed of the new stream channel and in the bottom of the pipe to fill a minimum of 20-percent of the rise. Through engineering methods, the size of stream substrate will be designed to be dynamically stable for flows up to a 50-year flood. The gradation of the stream substrate will be designed using methods first published as guidelines by Washington Department of Fish and Wildlife (WDFW) to replicate gradations of naturally occurring substrates.

Existing and proposed conditions were modeled with HEC-RAS. For this size culvert, HEC-RAS defaults to a slightly different dimensioned 4'-5" by 3'-4" pipe arch. Results of modeling indicate that the proposed culvert will pass the 50-year flood with headwater elevation to culvert rise equal to 0.89 and 0.58 at the highway and frontage road, respectively.

Table 11. "Subdivision" Creek crossing Seward Highway – H&H Summary

Drainage Area = 0.6-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	29	49	60
Flow depth at inlet (ft)	1.77	2.08	2.21
Hw/D	0.76	0.89	0.95

Table 12. "Subdivision" Creek crossing Frontage Road – H&H Summary

Drainage Area = 0.6-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	29	49	60
Flow depth at inlet (ft)	0.96	1.34	1.59
Hw/D	0.41	0.58	0.68

6.5 23 CFR

No Flood Insurance Studies boundaries are mapped for this tributary (FEMA FIRM, 1987). The proposed action includes a culvert larger in size and more hydraulically efficient than the existing culvert. Hydraulic analysis indicates that the upstream water surface elevations will be lower with the proposed culvert than currently exist.

Risks of the proposed culvert are considered minimal. There is a reduction in upstream backwater affects and greater conveyance area for flows and debris through the pipe. Floodplain values are not expected to be impacted.

6.6 Conclusion

The hydraulic features of the proposed action are developed to a preliminary level at this phase in support of the Preliminary Engineering Report. The proposed culvert is not expected to adversely impact the floodplain or environment. The proposed culvert meets ADOT&PF requirements for flood conveyance of the 50-year event.

The proposed culvert was designed for fish passage using the Tier 1 method to simulate typical adjacent stream conditions. This provides favorable continuity of stream processes and passage of fish through the culvert from adjacent stream reaches.

The hydrologic and hydraulic summary for the proposed Seward Highway culvert is presented in Table 11. The hydrologic and hydraulic summary for the proposed Frontage Road culvert is presented in Table 12.

6.7 Riprap

The culvert was designed to provide fish passage using Tier 1 stream simulation to maintain continuity of flow of water and sediment. No scour is noted for existing conditions; proposed conditions will have a larger culvert at a flatter gradient with less energy for scour. Therefore, no riprap is proposed at this preliminary phase.

6.8 Existing conditions photos

Photos of existing conditions follow on the next two pages.

.8—Existing conditions photos

"Subdivision" Creek looking upstream from inlet to highway culvert

"Subdivision" Creek—outlet from highway culvert

“Subdivision” Creek—Stream below ARRC

“Subdivision” Creek—Waterfall at Turnagain Arm shoreline

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8 Appendices:

App 1 - Culvert drawings

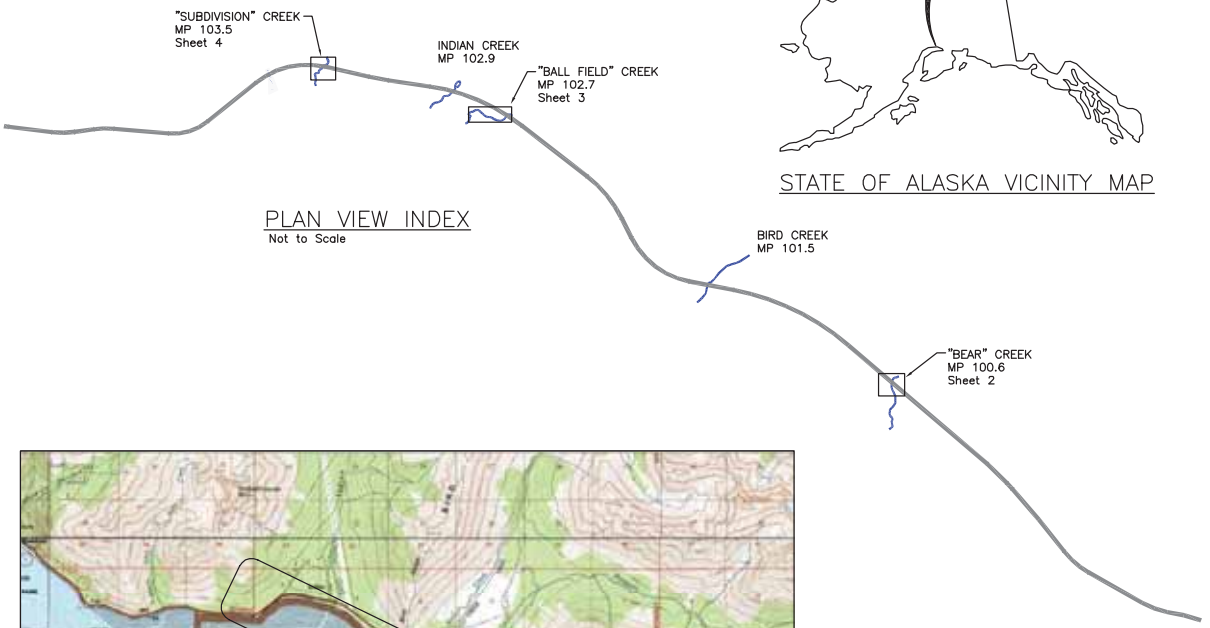
App 2 - Rapid assessment tables

App 3 - Hydraulic analysis

App 1 - Culvert drawings

State of Alaska
Department of Transportation and Public Facilities

Seward Highway, Bird to Indian
MP 99 to MP 105
ADOT&PF State Project #53577



PLAN VIEW INDEX
Not to Scale

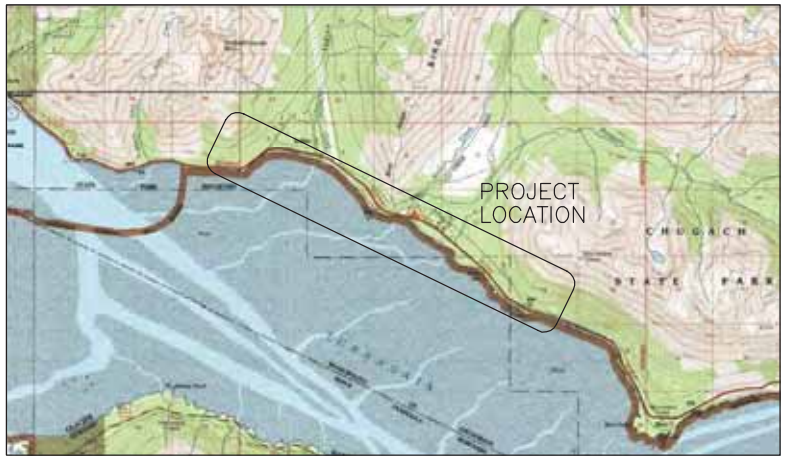
STATE OF ALASKA VICINITY MAP

SHEET INDEX

Note:

Base Imagery provided by DOWL Engineers 2006

PRELIMINARY



USGS VICINITY MAP
Not to Scale

NO.	BY	DATE	REVISION DESCRIPTION

RP & NS	DM,GK,MS	DM,GK,MS
DRAWN	DESIGNED	CHECKED
DM,GK,MS	08/10/07	
APPROVED	DATE	PROJECT

State of Alaska Department of Transportation and Public Facilities. Seward Highway Bird to Indian – MP 99 to MP 105

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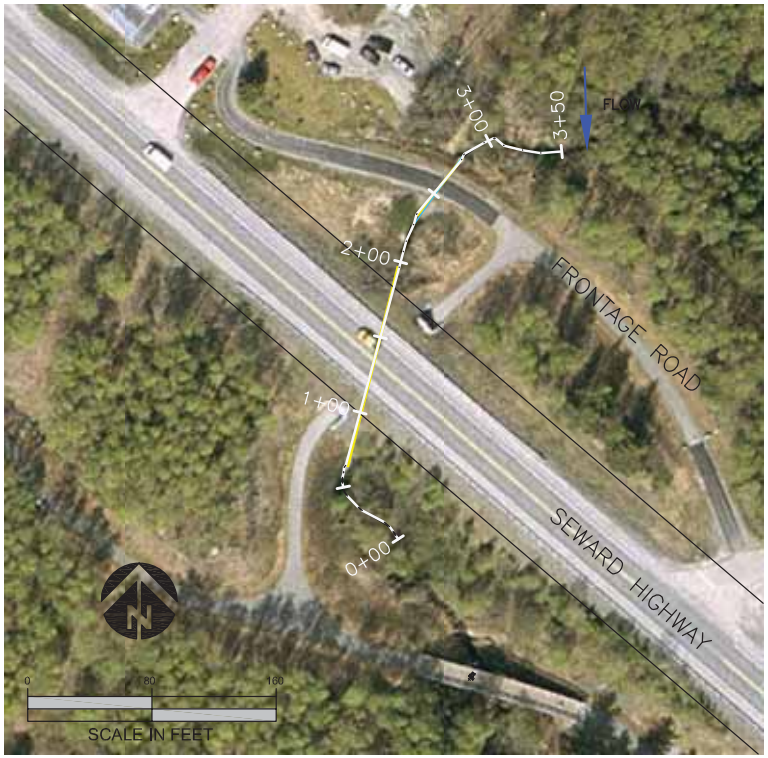
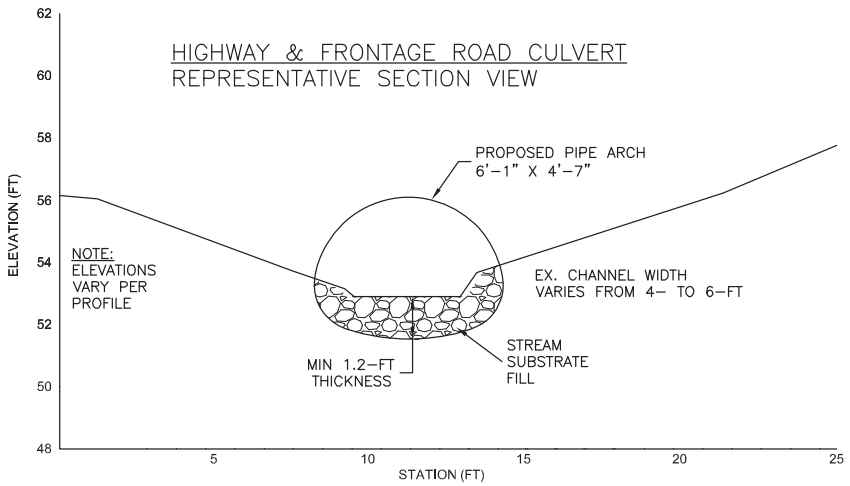
Hydraulics and Hydrology
Cover Sheet

SHEET
1 OF 4





HYDRAULIC SUMMARY

Table 1. "Bear" Creek crossing Seward Highway – H&H Summary

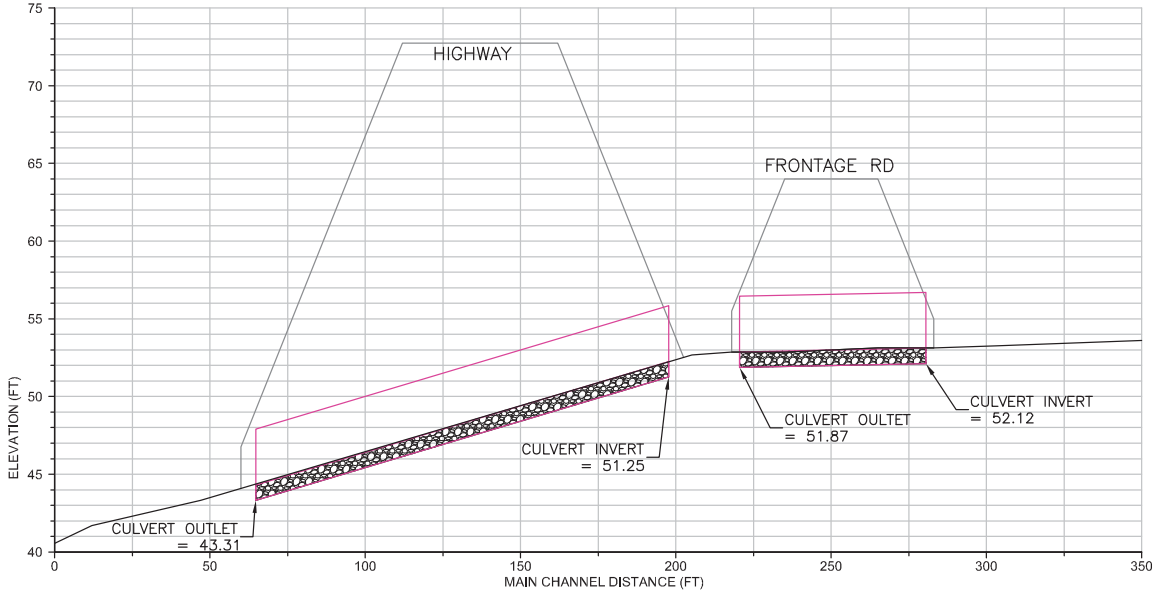
Drainage Area = 0.66-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	30	52	63
Flow depth at inlet (ft)	1.76	2.18	2.36
Hw/D	0.49	0.61	0.66

Table 2. "Bear" Creek crossing Frontage Road – H&H Summary

Drainage Area = 0.66-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	30	52	63
Flow depth at inlet (ft)	1.58	2.11	2.35
Hw/D	0.44	0.59	0.66



CHANNEL PROFILE

vertical exaggeration 5:1

NO.	BY	DATE	REVISION DESCRIPTION

RP DRAWN | DM,GK,MS DESIGNED | DM,GK,MS CHECKED
DM,GK,MS APPROVED | 08/10/07 DATE | PROJECT

State of Alaska Department of Transportation and Public Facilities – Seward Highway
Bird to Indian – MP 99 to 105

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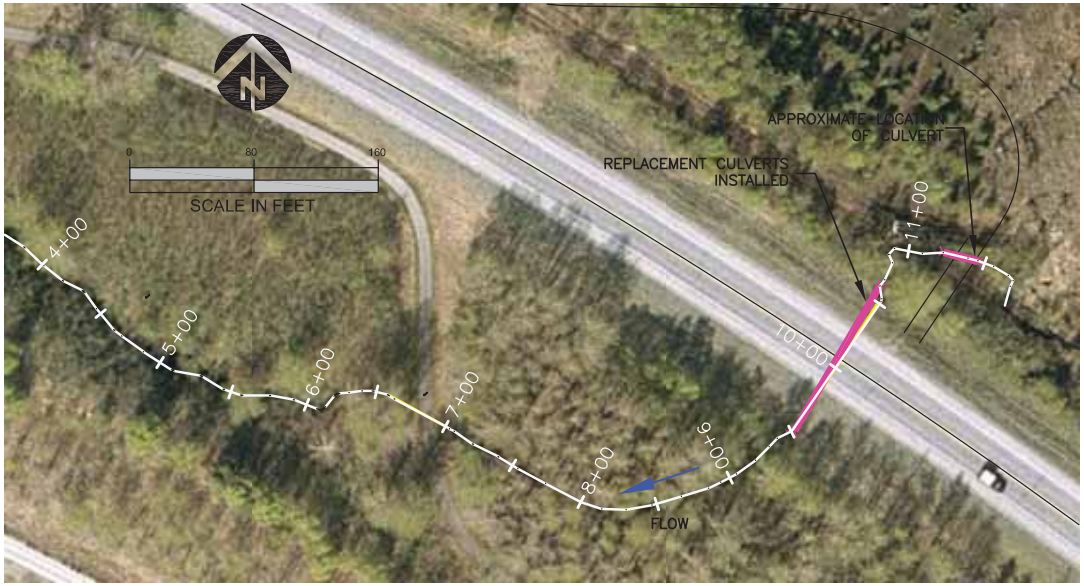
Hydraulics and Hydrology
"Bear" Creek Plan View

SHEET 2 OF 4



HYDRAULIC SUMMARY

Table 1. "Ball Field" Creek crossing Seward Highway – H&H Summary

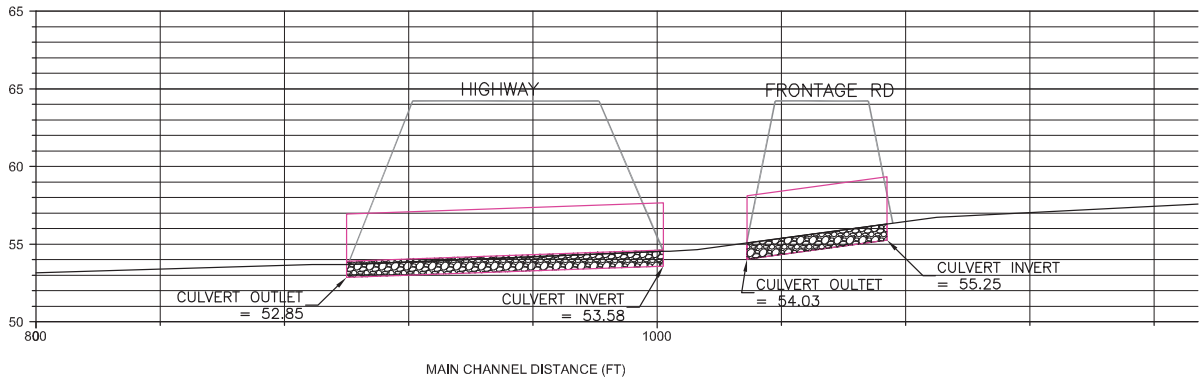
Drainage Area = 0.6-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	29	49	60
Flow depth at inlet (ft)	1.58	2.37	2.7
Hw/D	0.52	0.78	0.89

Table 2. "Ball Field" Creek crossing Frontage Road – H&H Summary

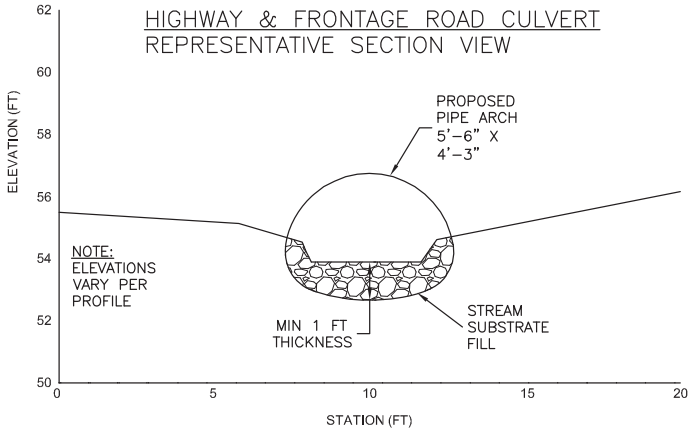
Drainage Area = 0.6-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	29	49	60
Flow depth at inlet (ft)	1.56	1.97	2.12
Hw/D	0.51	0.65	0.70



CHANNEL PROFILE

vertical exaggeration 5:1



NO.	BY	DATE	REVISION DESCRIPTION

DRAWN	DESIGNED	CHECKED
RP	DM,GK,MS	DM,GK,MS
APPROVED	DATE	PROJECT
DM,GK,MS	08/10/07	

State of Alaska Department of Transportation and Public Facilities – Seward Highway Bird to Indian – MP 99 to 105

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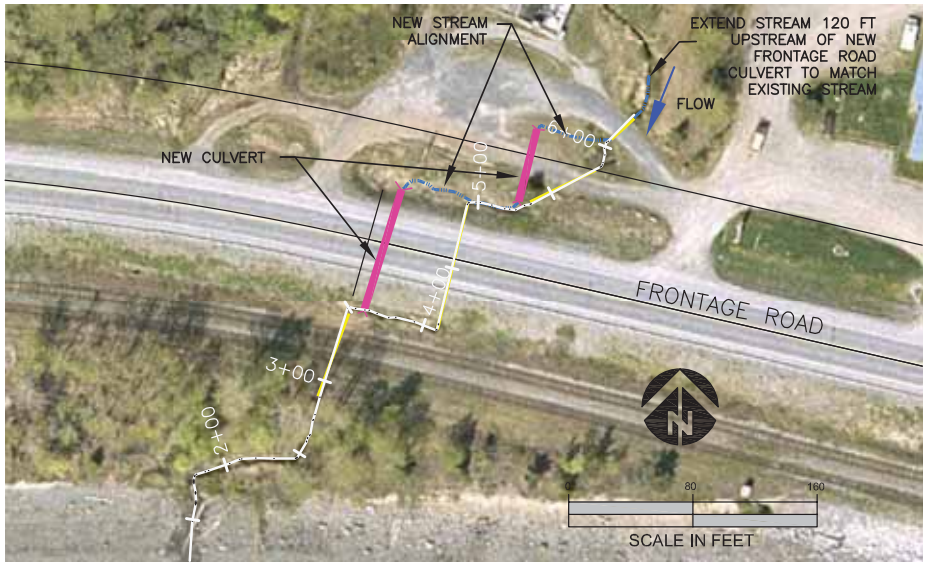
Hydraulics and Hydrology
"Ball Field" Creek Plan View

SHEET 3 OF 4



HYDRAULIC SUMMARY

Table 1. "Subdivision" Creek crossing Seward Highway – H&H Summary

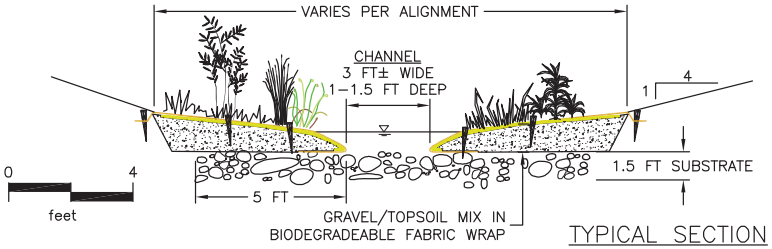
Drainage Area = 0.6-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	29	49	60
Flow depth at inlet (ft)	1.77	2.08	2.21
Hw/D	0.76	0.89	0.95

Table 2. "Subdivision" Creek crossing Frontage Road – H&H Summary

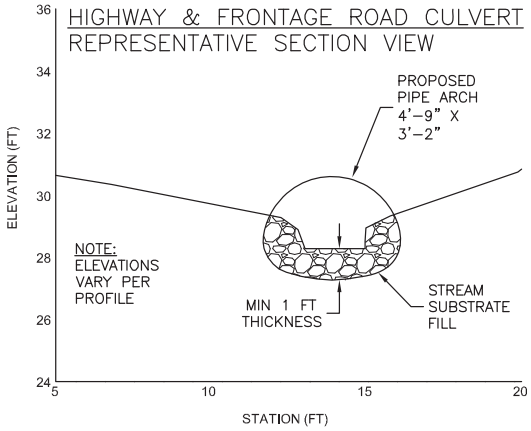
Drainage Area = 0.6-square miles

Exceedance probability	10%	2%	1%
Return period	10-year (Q10)	50-year (Q50)	100-year (Q100)
Design discharge (cfs)	29	49	60
Flow depth at inlet (ft)	0.96	1.34	1.59
Hw/D	0.41	0.58	0.68



TYPICAL SECTION
STREAM REALIGNMENT

CHANNEL PROFILE
vertical exaggeration 5:1



NO.	BY	DATE	REVISION DESCRIPTION

RP	DM,GK,MS	DM,GK,MS
DRAWN	DESIGNED	CHECKED
DM,GK,MS	08/10/07	
APPROVED	DATE	PROJECT

State of Alaska Department of Transportation and Public Facilities – Seward Highway Bird to Indian – MP 99 to 105

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Hydraulics and Hydrology
"Subdivision" Creek Plan View

SHEET
4 OF 4

App 2 - Rapid assessment tables

Culvert Rapid Assessment

Seward Highway - MP 99 to 105 (Bird to Indian) ADOT&PF State Project No. 53577

Site ID	Sheet	Station (approx)	Stream Name	Photos	Shape	Material	Dimensions (in)	Water Depth Inside Culvert (ft)	Outfall Drop (ft)	Streambed Material in Culvert	Fill Depth (ft) inlet	Fill Depth (ft) outlet	Plunge Pool Length (ft)	Plunge Pool Maximum Depth (ft)	Plunge Pool OHW Width (ft)	Average Streambed Width (ft)	Damage	Fish Passage notes	Stainline (ft) inlet	Stainline (ft) outlet	Drainage	Vegetation	Other notes inlet	Other notes outlet	US Waters
SH1	21	606+05			round	corrugated steel	36	0.75	0	y	2				3.5	3	bend in pipe a third of the way to the inlet	cascade 15' downstream of outlet	1.3				0.4' sediment; projecting from fill; cascade into plunge pool (6" deep)		
SH2	21	608+00			round	corrugated steel	24	trickle	0	y	2				3	2	roots with debris clogging 15% of outlet; slight damage to outlet				flow from west from road ditch at inlet; small hillslope tributary enters ditch 25' west of inlet	dense brush at outlet			
SH2.4	22	615+20		Cannon 63-68 (inlet) Cannon 69-72 (outlet)	round	corrugated steel	24	0.25	1.4	n	3	4.5				2		steep riprap slope extends from outlet (80-100')			drains road ditch from east and west at inlet; tributary from hillslope provides all the flow		0.1' of material		
SH2.6	22	615+80		Cannon 57-59 (inlet) Cannon 60-62 (outlet)	round	corrugated steel	24	0		n	2.5					no defined channel		steep riprap slope extends from outlet (80-100')			drains road ditch from east and west at inlet		0.1' of material		
SH2.8	22	616+75		Cannon 49-54 (inlet) Cannon 55-56 (outlet	round	corrugated steel	36	0.05	0.2	n	3					0.5		drains onto steep slope (80' long, 40 degrees)			trickle through culvert; drains road ditch from east and west sides;				
SH3	22	617+50			round	corrugated steel	24	0		n		5					inlet squashed at top 0.6'	outlet too steep for fish				equizeteem encroaching inlet; cottonwood, willow and equizeteem at outlet		small trickle at outlet	
SH4	22	620+70			round	corrugated steel	24	0.1	2.2	n	3		3	0.4	4.5	2.5		Second culvert under access road is 50-ft d/s of outlet. [Channel] drops off steeply d/s of acces rd culvert no possible fish access	0.55	0.15	drains E and W road ditch and small hillslope trib (trib enters ditch ~20-ft W of inlet).				
SH5	22	623+80			round	corrugated steel	24	0		y	2.4	6				2		inlet clogged with fines and small gravel from a hillslope failure (40' wide); 3' drop 3' downstream of outlet						0.05' of material	
SH6	22	631+00			round	corrugated steel	36	0.2	0.9	n	2.8	10				3.5	pipe separated 6' upstream of outlet	steep cascade at outlet for 60' down to bike path; steep cascade 30' upstream of inlet	2.3	2.5	drains hillslope tributary				
SH7	22	632+80			round	corrugated steel	24	0.05	0.9	n	2.5	9				1.5	moderately rusted and squashed at inlet	0.8' of debris clogging inlet; cascade 6' upstream of inlet	1.8	1		equizetum and alder at outlet			
SH8	23	638+80		Cannon 96-98	round	corrugated steel	24	0.03	1.3	n	8	7				3.5	erosion at outfall is beginning to undermine culvert	steep drop-off downstream and 3' of incision may prevent passage		1	drains hillslope tributary and east and west drainage ditches	inlet obscured by grass and equizetum	0.5' of material		
SH9	23	644+00			round	corrugated steel	24	0.1 (inlet); 0.2 (outlet)		n	13					3		not too steep but size of stream may be limiting	1.5	1.5	drains small tributary and road ditch	inlet is brushy	0.7' of debris and then clear	0.9' of debris	
SH10	23	646+80			round	corrugated steel	36	0.2	2.2	n	13					4	slightly squashed at inlet		2	1.1			debris in inlet 4' downstream then clear; 0.7' of material	3.5' upstream of culvert under bike path	
SH11	23	648+10		Cannon 111-112 (outlet) Cannon 113-114 (inlet)	round	corrugated steel	24	0		n	11	22				no defined channel	outlet is bent	0.7' of material plugging inlet			drains road ditch		4' downstream of inlet large rock removed		
SH12	23	658+30		Cannon 115-117 (inlet)	round	corrugated steel	24	0.03	1.1	n	10	30				2	inlet damaged 0.7' from bottom	plunges into steep cascade at outlet	1.8	1.6					
SH13	24	670+00		Cannon 139-140 (inlet) Cannon 141-142 (outlet)	round	corrugated steel	24	0		n	3.5								1.3		drains incised road ditch (6' long and 2' deep)		inlet invert 1' above ditch invert	0.7' of debris in 3' of the outlet otherwise clear	n
SH14	24	687+75	Bear Creek	Cannon 143-145 (inlet) Cannon 146-150 (outlet)	round	corrugated steel	48	0.3 (inlet); 0.25 (outlet)	1.4	n	4.5	5.5				4.5 (inlet); 5.5 (outlet)	outlet being undermined several feet	outlet is a barrier because of large rip-rap rocks and brush	2.6	2.3					y
SH15	25	697+00			round	corrugated steel	24	0		y	2						inlet bent				drains road ditch		0.2' of material	0.3' of material	n
SH16	25	700+75			round	corrugated steel	24	0		y	6					no defined channel	outlet squashed and buried		1.6		drains road ditch	outlet overgrown by brush and grass	0.3' of debris	0.8' of debris; 0.05' standing water	n
SH17	25	703+80			round	corrugated steel	24	0		n	4					no defined channel	some rim damage at inlet (0.3')		2		drains road ditch			material fills to stainline	n
SH18	25	711+00		Cannon 166-168 (inlet) Cannon 169-171 (outlet)	round	corrugated steel	24	0		y	3	2.5				no defined channel			1.9	2	drains road ditch		0.5' of material	0.2' of material	n
SH19	28	800+60	Ballfield Creek		round	corrugated steel	24	0.5 (inlet); 0.7 (outlet)		y	8					4 (inlet); 5 (outlet)		passage barrier for upstream juveniles at outlet of culvert under bike path		1.8	drains tributary, low gradient, good flow		0.1' of material	0.4' of material	y
SH20	29	826+60		Cannon 194-196 (inlet) Cannon 197-199 (outlet)	round	corrugated steel	24	0		y	4	7				no defined channel					drains swale extending 90 degrees from highway inlet		0.4' of material	0.15' of material	n
		station equation: 835+03.26 back = 80+67.72 ahead																							
SH21	30	82+25		Cannon 200-202 (inlet) Cannon 203-205 (outlet)	round	corrugated steel	24	0.1	3.4	n	2.5	4				2		outlet plunges onto rocks and steep cascade down to RR	1.55	1.25	drains small tributary; outlet flow sources small stream that flows east along the RR and empties into Indian Creek just upstream of RR culvert inlet		0.5' of material at inlet but clear beyond 1'		y
SH22	30	90+50	Subdivision Ck		round	corrugated steel	24	0.3 (inlet); 0.5 (outlet)		n	5	12				2	slightly squashed at outlet		1.8		drains small tributary			0.9' of material; inlet of culvert under RR is 5' downstream of outlet	y
SH23	30	91+00			round	corrugated steel	36	0.2 stagnant at inlet	0.45		5	8	2.5	0.4	2	1.5 (outlet)				1.4	drains road ditch and trib of SH22 at high flows	equizetum at inlet			n
SH24	30	96+20			round	corrugated steel	36	0		n	3	5				no defined channel					drains road ditch			0.2' of material	n
SH25	30	103+60			round	corrugated steel	24	0 (inlet); 0.1 (outlet)		n	7	12				1			1.1	1.55	drains road ditch and small hillslope tributary			water flowing at outlet that has percolated through holes in the pipe, also flow under the culvert at outlet; inlet to RR culvert 3' downstream of outlet; rip rap rocks at outlet	y
SH26	31	108+00			round	corrugated steel	24	0		n	3	4 (to RR track)				no defined channel									
SH27	31	109+80			round	corrugated steel	24	0		n	3	9				no defined channel	inlet rim bent less than 0.8' at the top and side			0.9	drains road ditch		0.05' of debris then clear 1' back	almost completely clogged (1.8') with soil rock and debris	n
SH28	31	113+05			round	corrugated steel	24	0	0.6	n	2.5	6					0.7' of damage to side rim		1	1	drains road ditch	grasses encroaching on the inlet	0.05' of material	pipe goes under RR as well with a stand pipe between the RR and road; empties onto rip-rap embankment at the ocean	n
SH29	31	126+80			round	corrugated steel	24	0		n	1	6				no defined channel	rim cut and peeled back in places				drains road ditch	willows encroaching at the inlet	0.7' of coarse sand	0.2' of material, mainly leaves; appears clear 5' back; 20' downstream is cliff at side of RR track	
SH30	31	131+05			round	corrugated steel	24	0				5				no defined channel	rim bent 0.6' at top		1	N/A	drains road ditch	grasses, small aspens and equizetum are encroaching the inlet	0.9' of coarse sand and debris; mostly clear 4' back	1.1' of soil with grass and equizetum plugging up culvert; less material inside	n
SH31	32	136+20			round	corrugated steel	24	0		n	2	4				no defined channel		outlet perched 2.1'			drains road ditch		0.4' of soil and debris	empties onto a steep embankment; undercut 2-3'	n
SH32	32	141+50			round	corrugated steel	24	0	0.3	n	2	4.5									drains road ditch		0.6' of material	not much sign of water coming through; empties onto rocky and steep embankment	n
SH33	32	143+80			round	corrugated steel	24	0.02	0.4	n	1	3				no defined channel				1	drains road ditch and hillslope tributary; seep entering ditch ~50 degrees to the east	grasses encroaching at the outlet	1.2' of material but mostly clear; material sliding off steep hillslope is plugging the inlet	empties onto a steep embankment	y
SH34	32	155+40			round	corrugated steel	24	0		n	1	5				no defined channel	rim bent 0.5' at the top				drains road ditch		0.2' of dirt, grass and rocks	0.02' of coarse sand; drains onto a steep sandrock slope	n
SH35	32	159+60			round	corrugated steel	24	0.15	1.6	n		5				2.8	rim bent 0.4' at the top		1.7	1.5	drains road ditch and hillslope tributary that enters ditch 40' to the west from a 15' waterfall		0.2' of material	falls onto rocks (no plunge pool); RR culvert inlet is about 12' downstream of outlet	y
SH36	32	161+00			round	corrugated steel	24	0.04	3.3	n	1	3.5				1.5	damaged severely at the inlet (3' of pipe broken, pulled apart and bent)			1.2	drains road ditch with some seepage from hillslope cliff	grasses and equizetum encroaching on the inlet	water ponded in ditch; mostly clear with only 0.1' of materia	empties into ditch between RR and road embankment	n
SH37	33	764+00			round	corrugated steel	36	0.15	3.85	n	1.5		3	0.4	4	3.5				1.9	drains road ditch and two tributaries		1.1' of material; mixed inle	RR culvert is 10' downstream of outlet	y
SH38	33	170+50		Cannon 66-68 (inlet); Cannon 69-71 (outlet)	round	corrugated steel	24	0	2.2	n	2	5.5					rim damage				drains road ditch	small cottonwood and grass at inlet	0.3' of material	projects 2.9' from bank; empties onto steep slope of rock	n
SH39	33	173+10		Cannon 72-74 (inlet); Cannon 75-77 (outlet)	round	corrugated steel	24	0		n	1.5	6				no defined channel			0.9		drains road ditch	grasses, equizetum, fireweed and cottonwoods are encroaching on the inlet	0.8' of material and then clear 2' back	1' of material and then clears	n

Note: Sheet number from ADOT&PF project no. F-031-2(55) plans dated 1981

App 3 - Hydraulic analysis