

# ENGINEERS INSPECTION REPORT

INSPECTOR: DGM

OFFICE OF THE STATE ENGINEER - DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH 1313 SHERMAN ST., ROOM B18, DENVER, CO 80203, (303) 866-3581

DAM NAME: SUMMITVILLE TAILINGS	T: 370N R: 0040E S: 30	COUNTY: RIO GRANDE	DATE OF INSPECTION: 7/14/2005
DAM ID: 210103	YRComp: 1968	DAM HEIGHT(FT): 80.0	SPILLWAY WIDTH(FT): 61.0
CLASS: 3		DAM LENGTH(FT): 675.0	SPILLWAY CAPACITY(CFS): 5940.0
DIV: 3	WD: 21	CRESTWIDTH(FT): 20.0	FREEBOARD (FT): 9.0
EPP: Not Required		CRESTELEV(FT): 11230.0	DRAINAGE AREA (AC.): 2560.0
			PREVIOUS INSPECTION: 10/3/2000
			CAPACITY(AF): 276.0
			SURFACE AREA(AC): 16.0
			OUTLET INSPECTED:

**CURRENT RESTRICTION -- NONE --**

OWNER: COLORADO DEPT OF PUBLIC HEALTH & ENVIRONM      CONTACT NAME: AUSTIN BUCKINGHAM  
 ADDRESS: MC: HMD-RP-B2      CONTACT PHONE: (303) 692-3435  
 DENVER      CO      80246

INSPECTION PARTY: Austin Buckingham      Joe Fox      Dennis Witte  
 REPRESENTING: CDPHE      RTG/Golder Assoc.      RTG/Golder Assoc.

<b>FIELD CONDITIONS OBSERVED</b>	WATER LEVEL: BELOW DAM CREST      10.75      FT.      Below Spillway      1.75      FT.	GAGE ROD READING      11219.75
	GROUND MOISTURE CONDITION:      DRY <input checked="" type="checkbox"/> WET <input type="checkbox"/> SNOWCOVER <input type="checkbox"/> OTHER	Sunny, cool, breezy, dry

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY

<b>UPSTREAM SLOPE</b>	<p><b>PROBLEMS NOTED</b> <input type="checkbox"/> (0) NONE      <input checked="" type="checkbox"/> (1) RIPRAP - MISSING, SPARSE, DISPLACED, <u>WEATHERED</u>      <input type="checkbox"/> (2) WAVE EROSION - WITH SCARPS</p> <p><input type="checkbox"/> (3) CRACKS WITH DISPLACEMENT      <input type="checkbox"/> (4) SINKHOLE      <input checked="" type="checkbox"/> (5) APPEARS TOO STEEP      <input type="checkbox"/> (6) DEPRESSIONS OR BULGES      <input type="checkbox"/> (7) SLIDES</p> <p><input type="checkbox"/> (8) CONCRETE FACING - HOLES, CRACKS, DISPLACED, UNDERMINED      <input type="checkbox"/> (9) OTHER</p> <p><u>Generally good coverage of angular hard rock riprap on exposed portion of slope; some areas of soil mixed in with riprap. Fairly uniform slope overall. (1) Some weathering of scattered softer rock pieces along slope, due to severe (cont. pg 3)</u></p>
<b>CREST</b>	<p><b>PROBLEMS NOTED</b> <input type="checkbox"/> (10) NONE      <input checked="" type="checkbox"/> (11) RUT OR PUDDLES      <input type="checkbox"/> (12) EROSION      <input type="checkbox"/> (13) CRACKS - WITH DISPLACEMENT      <input type="checkbox"/> (14) SINKHOLES</p> <p><input type="checkbox"/> (15) NOT WIDE ENOUGH      <input type="checkbox"/> (16) LOW AREA      <input type="checkbox"/> (17) MISALIGNMENT      <input checked="" type="checkbox"/> (18) IMPROPER SURFACE DRAINAGE      <input type="checkbox"/> (19) OTHER</p> <p><u>Good width, which varies from 20 feet nominal to about 40 feet on the right end turnaround area. Good granular surfacing. Elevation is fairly uniform, except for built up area around generator unit, left of outlet section, which is about (cont. pg 3)</u></p>
<b>DOWNSTREAM SLOPE</b>	<p><b>PROBLEMS NOTED</b> <input type="checkbox"/> (20) NONE      <input type="checkbox"/> (21) LIVESTOCK DAMAGE      <input type="checkbox"/> (22) EROSION OR GULLIES      <input type="checkbox"/> (23) CRACKS - WITH DISPLACEMENT      <input type="checkbox"/> (24) SINKHOLE</p> <p><input checked="" type="checkbox"/> (25) APPEARS TOO STEEP      <input type="checkbox"/> (26) DEPRESSIONS OR BULGES      <input type="checkbox"/> (27) SLIDE      <input type="checkbox"/> (28) SOFT AREAS      <input type="checkbox"/> (29) OTHER</p> <p><u>Very hard, well-compacted rocky soil surface, with no vegetative cover, but no evident erosion problems. Fairly uniform appearance. Access road from left end of crest angles downward across slope to right abutment spillway crossing. (cont. pg 3)</u></p>
<b>SEEPAGE</b>	<p><b>PROBLEMS NOTED</b> <input type="checkbox"/> (30) NONE      <input checked="" type="checkbox"/> (31) SATURATED EMBANKMENT AREA      <input checked="" type="checkbox"/> (32) SEEPAGE EXITS ON EMBANKMENT</p> <p><input checked="" type="checkbox"/> (33) SEEPAGE EXITS AT POINT SOURCE      <input checked="" type="checkbox"/> (34) SEEPAGE AREA AT TOE      <input checked="" type="checkbox"/> (35) FLOW ADJACENT TO OUTLET      <input type="checkbox"/> (36) SEEPAGE INCREASED / MUDDY</p> <p>DRAIN OUTFALLS SEEN      <input checked="" type="checkbox"/> No      <input type="checkbox"/> Yes      Show location of drains on sketch and indicate      <input type="checkbox"/> (37) FLOW INCREASED / MUDDY      <input type="checkbox"/> (38) DRAIN DRY / OBSTRUCTED</p> <p><input checked="" type="checkbox"/> (39) OTHER      Abutment seepage; spillway seepage</p> <p><u>Dam has no known drain outfall pipes. Reservoir filled from 6' above empty this spring, peaking at G.H. 11220.0 six days prior to this inspection, &amp; has been drawdown only 3" since. (31)(32) A previously unnoted area of wetness and minor (cont. pg 3)</u></p>
<b>OUTLET</b>	<p><b>PROBLEMS NOTED</b> <input type="checkbox"/> (40) NONE      <input type="checkbox"/> (41) NO OUTLET FOUND      <input type="checkbox"/> (42) POOR OPERATING ACCESS      <input type="checkbox"/> (43) INOPERABLE</p> <p><input type="checkbox"/> (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED      (45) OUTLET OPERATED DURING INSPECTION      <input checked="" type="checkbox"/> YES      <input checked="" type="checkbox"/> NO</p> <p>INTERIOR INSPECTED      <input checked="" type="checkbox"/> (120) NO      <input type="checkbox"/> (121) YES      <input type="checkbox"/> (46) CONDUIT DETERIORATED OR COLLAPSED      <input type="checkbox"/> (47) JOINTS DISPLACED      <input type="checkbox"/> (48) VALVE LEAKAGE</p> <p><input checked="" type="checkbox"/> (49) OTHER      Gate corrosion</p> <p><u>Dam has a pair of upper-level gravity outlet conduits located near the right end of the dam and positioned with their inverts about 13 feet below the spillway crest elevation. Both outlets are controlled by upstream slide gates activated by (cont. pg 3)</u></p>
<b>SPILLWAY</b>	<p><b>PROBLEMS NOTED</b> <input type="checkbox"/> (50) NONE      <input type="checkbox"/> (51) NO EMERGENCY SPILLWAY FOUND      <input checked="" type="checkbox"/> (52) EROSION WITH BACKCUTTING      <input type="checkbox"/> (53) CRACK - WITH DISPLACEMENT</p> <p><input type="checkbox"/> (54) APPEARS TO BE STRUCTURALLY INADEQUATE      <input type="checkbox"/> (55) APPEARS TOO SMALL      <input type="checkbox"/> (56) INADEQUATE FREEBOARD      <input checked="" type="checkbox"/> (57) FLOW OBSTRUCTED</p> <p><input type="checkbox"/> (58) CONCRETE DETERIORATED / UNDERMINED      <input type="checkbox"/> (59) OTHER</p> <p><u>Spillway consists of a trapezoidal open channel cut through rock on the right abutment, with a concrete crest section having a length of 61 feet. This spillway was reportedly designed to pass the 50% PMP (cont. pg 4)</u></p>

Conditions Observed		
<b>X</b>	<b>X</b>	
GOOD	ACCEPTABLE	POOR
UPSTREAM SLOPE		
<b>X</b>	<b>X</b>	
GOOD	ACCEPTABLE	POOR
CREST		
<b>X</b>	<b>X</b>	
GOOD	ACCEPTABLE	POOR
DOWNSTREAM SLOPE		
<b>X</b>	<b>X</b>	
GOOD	ACCEPTABLE	POOR
SEEPAGE		
	<b>X</b>	
GOOD	ACCEPTABLE	POOR
OUTLET		
	<b>X</b>	
GOOD	ACCEPTABLE	POOR
SPILLWAY		
	<b>X</b>	
GOOD	ACCEPTABLE	POOR

See Guidelines on Back of this Sheet

MONITORING

EXISTING INSTRUMENTATION FOUND  (110) NONE  (111) GAGE ROD  (112) PIEZOMETERS  (113) SEEPAGE WEIRS / FLUMES  
 (114) SURVEY MONUMENTS  (115) OTHER  
 MONITORING OF INSTRUMENTATION  (116) NO  (117) YES PERIODIC INSPECTIONS BY:  (118) OWNER  (119) ENGINEER

**(111) Pressure transducer in reservoir bottom. (112) On D/S slope. (113) At toe pond at maximum section. (117)(118) Site operator personnel on site on a regular basis.**

**X X**  
 GOOD ACCEPTABLE POOR

MONITORING

MAINTENANCE AND REPAIR

PROBLEMS NOTED:  (60) NONE  (61) ACCESS ROAD NEEDS MAINTENANCE  (62) CATTLE DAMAGE  
 (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE  (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE  
 (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE  (66) DETERIORATED CONCRETE - FACING, OUTLET SPILLWAY  
 (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE  (68) OTHER

**(67) As described above.**

**X**  
 GOOD ACCEPTABLE POOR

MAINTENANCE AND REPAIR

OVERALL CONDITIONS

**Dam impounds reservoir of site runoff prior to treatment and release; not a tailings dam. Review indicates that dam is not a statutorily exempt structure. Dam is in generally good condition.**

Based on this Safety Inspection and recent file review, the overall condition is determined to be:

(71) SATISFACTORY  (72) CONDITIONALLY SATISFACTORY  (73) UNSATISFACTORY

OVERALL CONDITIONS

**ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM**

**MAINTENANCE - MINOR REPAIR - MONITORING**

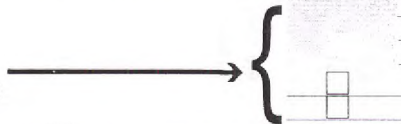
- (80) PROVIDE ADDITIONAL RIPRAP: \_\_\_\_\_
- (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE: **Annually; check annually for status of corrosion**
- (82) CLEAR TREES AND/OR BRUSH FROM: \_\_\_\_\_
- (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES: \_\_\_\_\_
- (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: \_\_\_\_\_
- (85) PROVIDE SURFACE DRAINAGE FOR: \_\_\_\_\_
- (86) MONITOR: **Seepage vs. res level; observe wet area above outlets for changes in size & quantity & quality**
- (87) DEVELOP AND SUBMIT AN EMERGENCY PREPAREDNESS PLAN: \_\_\_\_\_
- (88) OTHER: **Remove pipeline and support piers from spillway approach channel; remove log debris**
- (89) OTHER: \_\_\_\_\_

**ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO:** (Plans and Specifications must be approved by State Engineer prior to construction.)

- (90) PREPARE PLANS AND SPECIFICATIONS FOR REHABILITATION OF THE DAM: \_\_\_\_\_
- (91) PREPARE AS-BUILT DRAWINGS OF: \_\_\_\_\_
- (92) PERFORM A GEOTECHNICAL INVESTIGATION TO EVALUATE THE STABILITY OF THE DAM: \_\_\_\_\_
- (93) PERFORM A HYDROLOGIC STUDY TO DETERMINE REQUIRED SPILLWAY SIZE: \_\_\_\_\_
- (94) PREPARE PLANS AND SPECIFICATIONS FOR AN ADEQUATE SPILLWAY: \_\_\_\_\_
- (95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS: \_\_\_\_\_
- (96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET: \_\_\_\_\_
- (97) OTHER: **Consider placement of additional erosion protection in lower spillway channel**
- (98) OTHER: \_\_\_\_\_
- (99) OTHER: \_\_\_\_\_

**SAFE STORAGE LEVEL RECOMMENDED AS A RESULT OF THIS INSPECTION**

- (101) FULL STORAGE
- (102) CONDITIONAL FULL STORAGE
- (103) RECOMMENDED RESTRICTION
- (104) CONTINUE EXISTING RESTRICTION



FT. BELOW DAM CREST  
 FT. BELOW SPILLWAY CREST  
 FT. GAGE HEIGHT  
 NO STORAGE-MAINTAIN OUTLET FULLY OPEN

REASON FOR RESTRICTION

ACTIONS REQUIRED FOR CONDITIONAL FULL STORAGE OR CONTINUED STORAGE AT THE RESTRICTED LEVEL:

Engineer's Signature

*D. Smith*  
 INSPECTED BY

Owner's Signature

OWNER/OWNER'S REPRESENTATIVE

DATE: 7/14/05

MONITORING

EXISTING INSTRUMENTATION FOUND  (110) NONE  (111) GAGE ROD  (112) PIEZOMETERS  (113) SEEPAGE WEIRS / FLUMES  
 (114) SURVEY MONUMENTS  (115) OTHER  
 MONITORING OF INSTRUMENTATION  (116) NO  (117) YES PERIODIC INSPECTIONS BY:  (118) OWNER  (119) ENGINEER

MONITORING

X	X
GOOD	POOR
ACCEPTABLE	

**(111) Pressure transducer in reservoir bottom. (112) On D/S slope. (113) At toe pond at maximum section. (117)(118) Site operator personnel on site on a regular basis.**

MAINTENANCE AND REPAIR

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 (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE  (68) OTHER

MAINTENANCE AND REPAIR

X		
GOOD	ACCEPTABLE	POOR

**(67) As described above.**

OVERALL CONDITIONS

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OVERALL CONDITIONS

**ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM**

The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.

**MAINTENANCE - MINOR REPAIR - MONITORING**

- (80) PROVIDE ADDITIONAL RIPRAP: \_\_\_\_\_
- (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE: **Annually; check annually for status of corrosion**
- (82) CLEAR TREES AND/OR BRUSH FROM: \_\_\_\_\_
- (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES: \_\_\_\_\_
- (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: \_\_\_\_\_
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- (87) DEVELOP AND SUBMIT AN EMERGENCY PREPAREDNESS PLAN: \_\_\_\_\_
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- (89) OTHER: \_\_\_\_\_

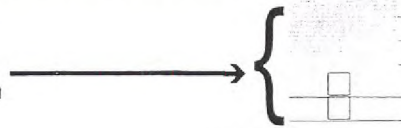
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- (95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS: \_\_\_\_\_
- (96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET: \_\_\_\_\_
- (97) OTHER: **Consider placement of additional erosion protection in lower spillway channel**
- (98) OTHER: \_\_\_\_\_
- (99) OTHER: \_\_\_\_\_

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- (102) CONDITIONAL FULL STORAGE
- (103) RECOMMENDED RESTRICTION
- (104) CONTINUE EXISTING RESTRICTION

REASON FOR RESTRICTION \_\_\_\_\_



FT. BELOW DAM CREST  
 FT. BELOW SPILLWAY CREST  
 FT. GAGE HEIGHT  
 NO STORAGE-MAINTAIN OUTLET FULLY OPEN

ACTIONS REQUIRED FOR CONDITIONAL FULL STORAGE OR CONTINUED STORAGE AT THE RESTRICTED LEVEL: \_\_\_\_\_

*Handwritten signature/initials*

Engineer's Signature

*Handwritten signature: D. Smith*

INSPECTED BY

Owner's Signature

*Handwritten signature: Paul J. Becking*

OWNER/OWNER'S REPRESENTATIVE

DATE

*Handwritten date: 5 Aug 2005*

pp 2 of 4

*Handwritten text: Summitville Project Manager*

**Upstream Slope (cont.)**

- (1)(cont.) climate conditions at high altitude site.
- (5) The exposed upper portion of the slope varies somewhat in inclination, from about 1.5:1 along the maximum section, to about 2:1 at the outlet section. No signs of instability were noted.

**Crest (cont.)**

- 1.5 feet above the surrounding crest elevation.
- (11) Minor.
- (18) Both the left end of the crest and the turnaround area at the right end appear to slope to the downstream side, which is not desirable for erosion control purposes.

**Downstream Slope (cont.)**

- (25) The upper part of the slope is oversteepened, to about 1.5:1, due to the presence of the access road fill across it. The lower slope inclination is more reasonable, and probably more representative of the actual dam slope, at about 2.5:1 to 3:1. Overall slope at the maximum section, measured from the downstream edge of the road fill to the toe, is 2:1.

**Seepage (cont.)**

- (31)(32)(cont.) seepage was observed on the downstream slope at the outlet section, just above the access roadway which angles across the slope there. The wet area was about 50 feet in length, parallel to the dam axis, and about 10 feet in width, and was producing a trickle of clear flow along the roadway ditch, flowing toward the spillway channel. The area had a mossy appearance, with some algae, but was not overly soft, being comprised of the hard rocky soil which makes up the downstream slope. This area should be watched closely for changes in size and quantity and clarity of seepage.
- (34) As noted in the past, clear seepage emerges from the rockfill toe of the dam at the maximum section, in the form of several small streams of several gpm each, discharging into a pond along the valley floor beyond the toe of the dam. This pond is about 20 feet wide by about 60 feet in length, and retains water to a depth of up to 2 feet. At the lower end of the pond, most of the discharge is routed through a 4" flume for measurement; head on the flume was measured at 0.12', or about 22 gpm. Another 5 – 10 gpm escapes from the pond to the left of the flume without being measured. The total amount of the flow from the pond was consistent with last year's observation with the reservoir at a similar level. Flow from the pond includes seepage from the lower right abutment, as described below.
- (33)(39)(a) As noted in the past, a point source of seepage emerges from the lower right abutment near the maximum section, about 6 feet to the right of the groin and about 20 vertical feet above the toe of the maximum section. This source of seepage was producing a clear flow of 2 – 3 gpm, which is consistent with past observations, with soft, wet ground conditions surrounding the seep area and extending downstream along the lower abutment for 20 – 30 feet. Flow from the seep area discharges across a bench fill on the lower right abutment, wetting it, before discharging down the slope of the bench fill to the seep pond described above.
- (35) As previously observed, minor seepage emerges from beneath both outlet conduits at their downstream ends; this amounted to 1 – 2 gpm from under the right conduit and about ¼ gpm from under the left. At the point where the outlet channel meets the spillway channel downstream of the dam, total seepage in the bottom of the outlet channel was estimated at about 5 gpm.
- (39)(b) Minor seepage emerges along the rock cut of the spillway channel, in the upper right abutment. The flow originates as trickles of seepage from the rock the right side of the spillway crest structure and at the downstream end of the left spillway wing wall. By the point where the spillway channel crosses the access roadway downstream, seepage along the spillway floor amounts to less than 5 gpm, due to small contributions of flow from the rock floor and right cut slope. By the lower end of the spillway channel, where it drops into the outlet channel, seepage flow has increased to about 10 gpm.

**Outlet (cont.)**

handwheels at the top of the upstream slope and inclined stainless steel stems mounted to a concrete support structure on the upstream slope. This outlet system is seldom used. The main, and preferred, method of withdrawing water from the reservoir is via a pumped outlet system, now powered by an REA electrical line from Del Norte. The intake is located on a floating barge in the reservoir, and water is conveyed to an on-site treatment plant, where it is treated to meet water quality standards before being released downstream via the Wightman Fork diversion channel, which passes around the north side of the reservoir.

Outlet (cont.)

- (45) The gravity outlet gates were closed at the time of this inspection, and were not operated. Joe Fox indicated that the gates were exercised full range and lubricated last summer when the reservoir was drawdown below the gates, and that both worked acceptably. The pumped outlet was in operation during this inspection, as usual, drawing 1010 gpm to the treatment plant, slightly more than the 900 gpm entering the reservoir from site runoff.
- (49) Corrosion of the cast iron gates and steel gate frames of the gravity outlet system has been a significant problem, due to the very low pH water retained in the reservoir. The gates and frames were coated with an epoxy paint several years ago to help retard the corrosion. Joe indicated that the gates were examined during last year's drawdown of the reservoir, and found to be in no worse condition than when the epoxy coating was applied.

Spillway (cont.)

- flood, and was constructed in 1993-94. The rock channel turns hard to the left at its lower end, and joins the outlet channel at a location about 200 feet downstream of the end of the outlet conduits. Large riprap is used to armor the outside of the curve to the outlet channel, and the area of the outlet channel where the spillway flow would enter it, but the outlet channel beyond that point is a steeply-sloping trapezoidal cut about 15 feet deep through soil to the natural stream channel of the Wightman Fork below the toe of the dam. This lower end of the spillway channel would likely suffer significant erosion during a large discharge event. However, operation of the spillway is avoided under normal operating conditions, to avoid releasing untreated water from the reservoir downstream. Recent construction of diversion channels and turnouts from the natural channels upstream of the reservoir now allow flows to be selectively diverted around the reservoir to avoid overfilling it.
- (52) Some erosion has occurred within the lower end of the spillway channel. CDPHE is considering placing additional erosion protection within the lower end of the channel to prevent further damage in the event of a large discharge event. Austin Buckingham indicated that any such work will be submitted to our office for review and approval prior to construction.
- (57) Three concrete support piers, used to support a pipeline which runs across the spillway channel, are present along the channel floor just upstream of the crest structure. These, and the support legs to the pipeline, would create some obstruction to flow. Also, a minor amount of driftwood was present around the crest structure.