Calgary Bow River Weir Project

Past to Present

- Original timber structures constructed in 1906.
- Replaced by concrete structures – completed in 1924.
- Current structures constructed in 1975.
- Parks Foundation Calgary (PFC) starts Calgary Bow River Weir Project in 2001.
- Golder Associates issues Preliminary Design Report in February 2007.
- Mack, Slack & Associates starts final design in November 2006.

Past to Present (Cont'd)

- PFC raises sufficient funds for the project to proceed to tender.
- Construction of project transferred to Alberta Transportation.
- Project tendered in summer of 2008.
- Construction contract awarded to the low bidder, DeGraaf Excavating Ltd. Low bid of $16.4 million. Project privately funded with significant contributions from City of Calgary, Calgary Foundation, Alberta Environment, Alberta Lotteries, and Alberta Government.
- Construction started in December 2008.
- Contractor is currently shut down for the winter.
- Construction to be completed by October 31, 2011.

Project Team

- **Klohn Crippen Berger Ltd. (KCB)**
  - Project Management
  - Design (hydrotechnical, civil, geotechnical, hydrogeological)
  - Preparation of Contract Documents
  - Construction Contract Administration and Resident Engineering
- **Northwest Hydraulic Consultants (Edmonton)**
  - Physical and Numeric Hydraulic Modelling Subconsultant
- **Recreation Engineering Planning (Boulder, Colorado)**
  - Recreational Hydraulics Subconsultant
- **Polster Environmental**
  - Bio-Engineering Subconsultant
- **Measurement Sciences**
  - Survey Subconsultant

Contract 7603/08 – Calgary Bow River Weir Project

- Primary objectives of the Project are to enable river passage for non-motorized boats and enhance upstream fish passage while maintaining water delivery to WH Canal.
- This is achieved by providing ten concreted boulder structures with constructed pools to provide two channels for boat and fish passage.
- The Low Water Channel (LWC) on river right consists of five concreted boulder structures and five constructed pools to provide a bypass channel for novice boaters to pass downstream and fish to pass upstream and downstream.
- The High Water Channel (HWC) consists of five concreted boulder structures and three constructed pools to provide whitewater play areas for more experienced boaters and for fish to pass upstream and downstream.

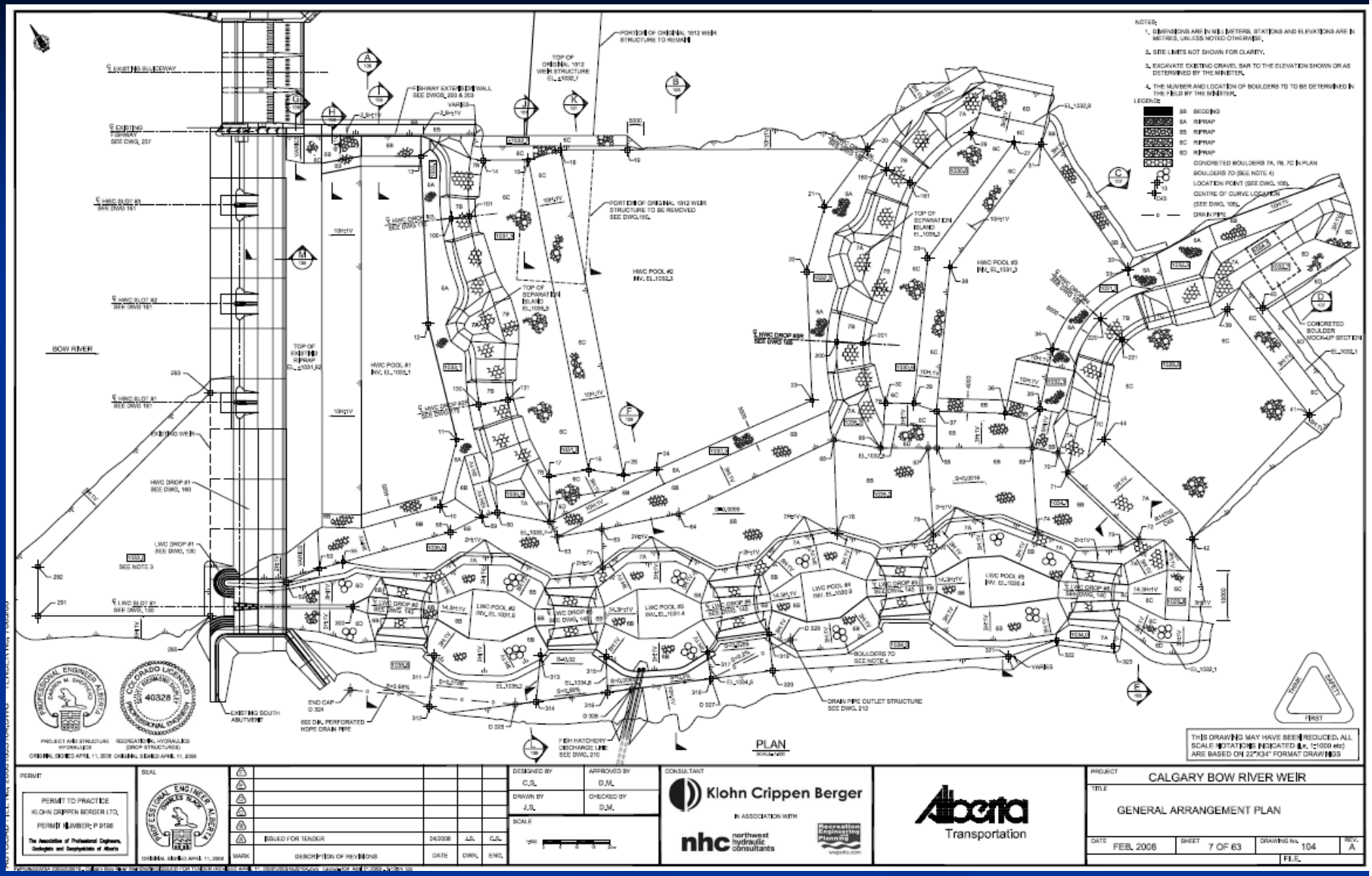
Contract 7603/08 (Cont'd)

- Modifications to the existing weir (HWC Drop #1) include removing portions of the weir at four locations and constructing a 4 m long cast-in-place concrete section with a vertical drop along the downstream side of the weir crest.
- Extending the fishway wall to contain the left (north) side of the HWC.
- Construction of islands within the river.
- Construction of a containment berm, complete with perforated drain pipe, on river right.

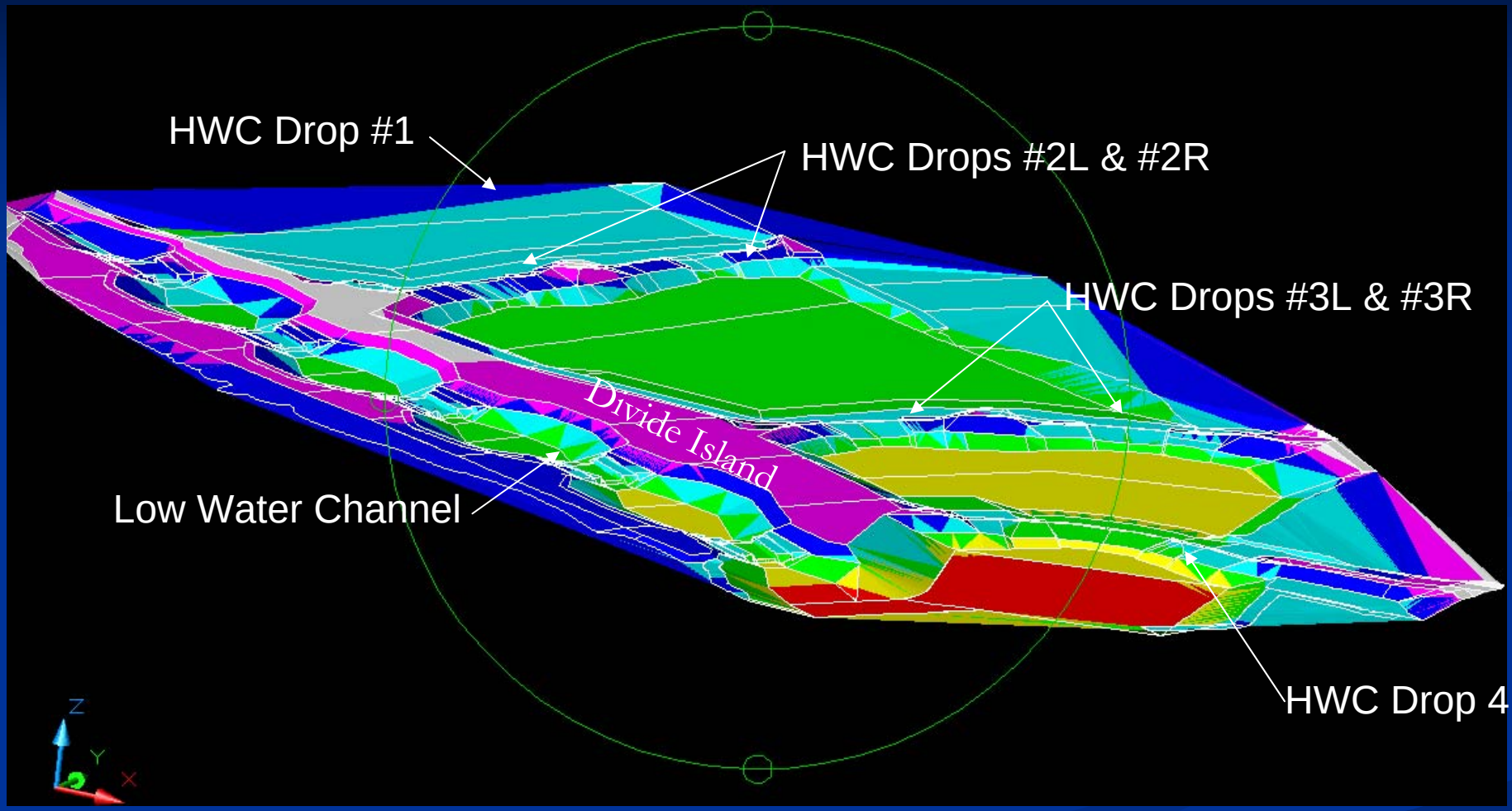
Calgary Bow River Weir Project
– HARVIE PASSAGE –

Artist's Rendering

Engineer's Rendering

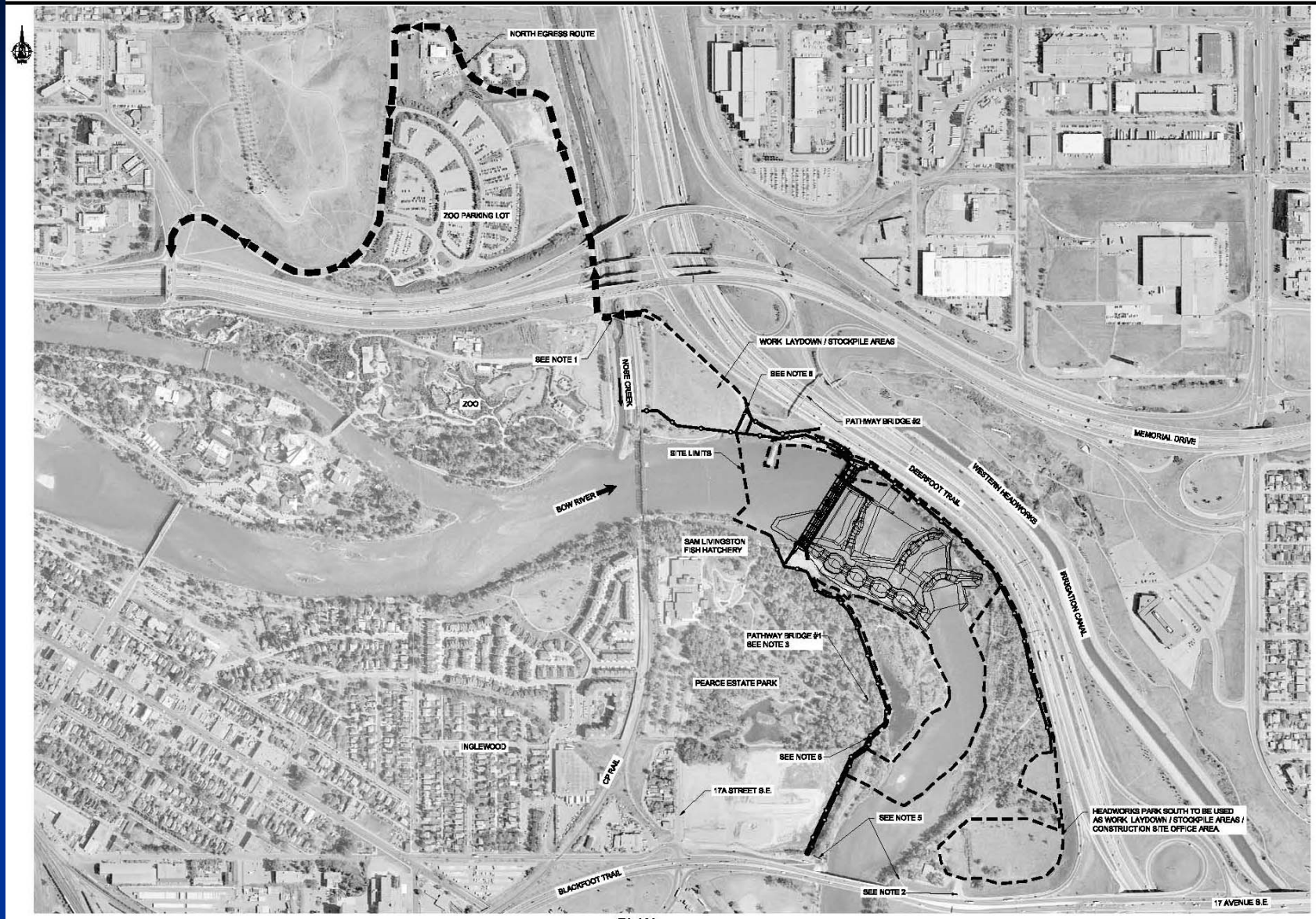


Project 3D Perspective



3D Digital Terrain Model Used for Design, Quantities, and Construction Layout

The Site



PLAN

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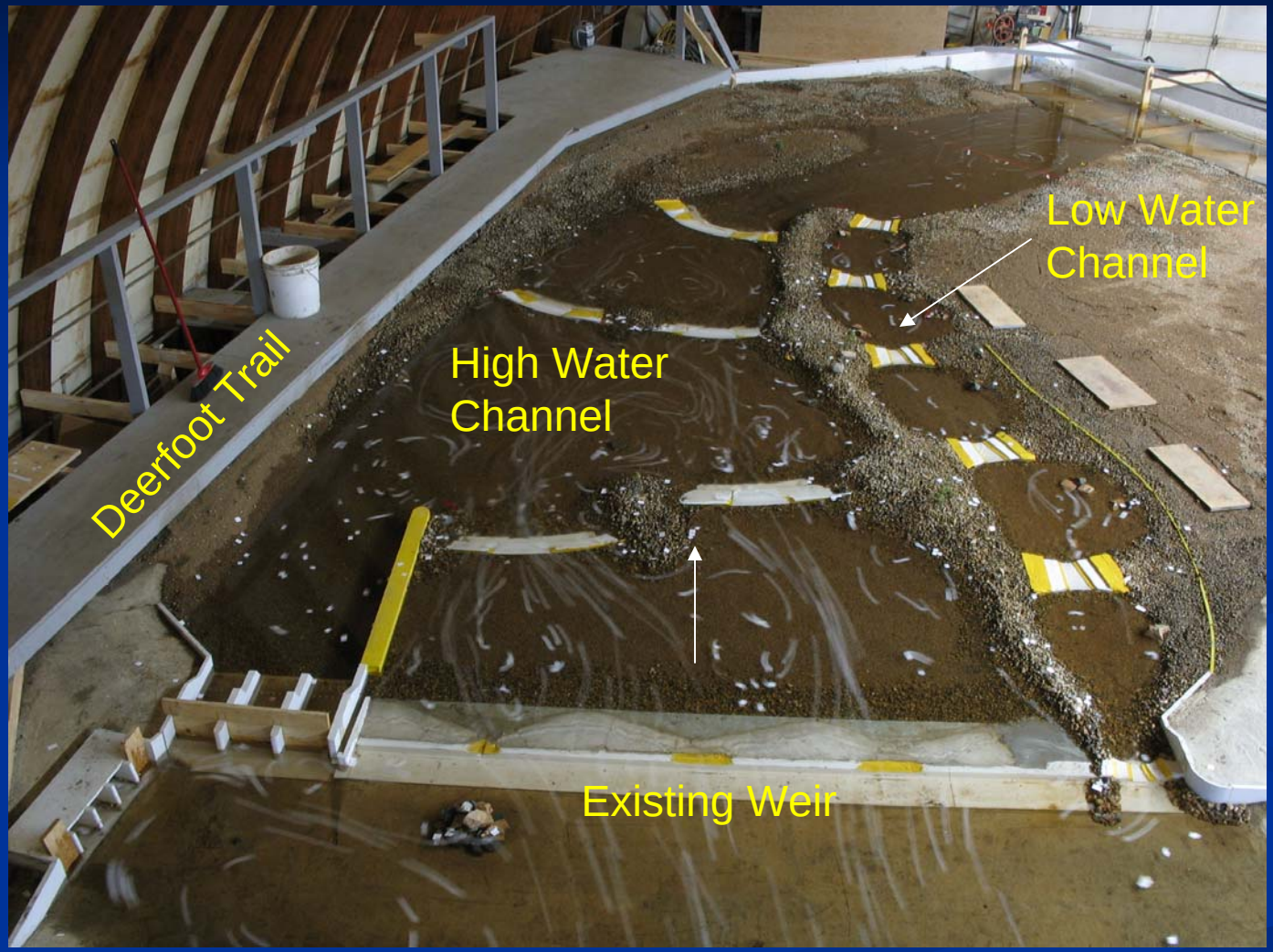
HWC Drop 1/Existing Weir
HWC Drop 2R
HWC Drop 2L
Deerfoot Trail
High Water Channel
HWC Drop 3R
HWC Drop 3L
Low Water Channel
HWC Drop #4



Physical Model Testing – Comprehensive Model

Simulated Fire Department Rescue
Discovery Channel Daily Planet

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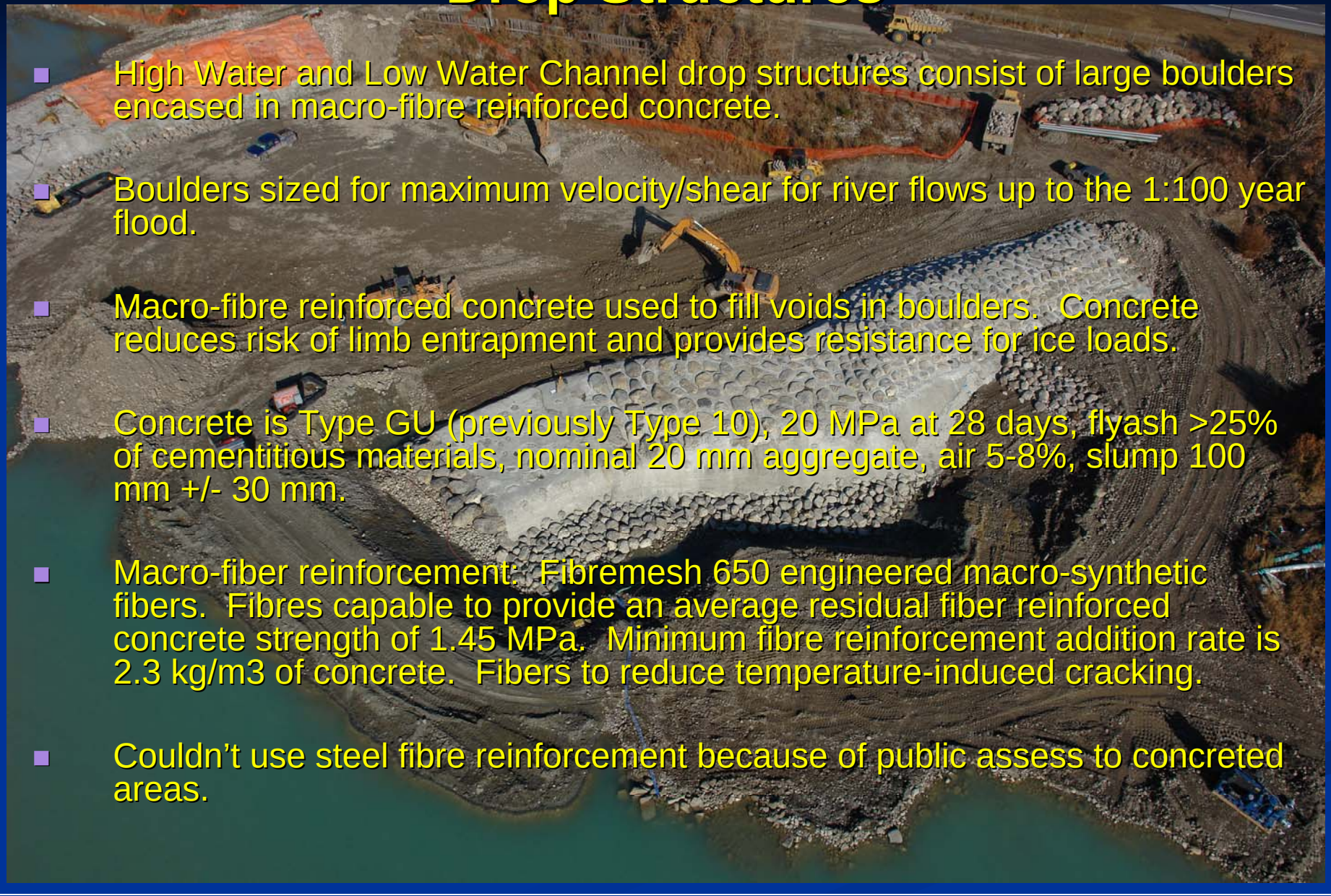
Physical Model Testing – Comprehensive Model Video

Physical Model Testing – HWC Drops

Drop Structures



- High Water and Low Water Channel drop structures consist of large boulders encased in macro-fibre reinforced concrete.
- Boulders sized for maximum velocity/shear for river flows up to the 1:100 year flood.
- Macro-fibre reinforced concrete used to fill voids in boulders. Concrete reduces risk of limb entrapment and provides resistance for ice loads.
- Concrete is Type GU (previously Type 10), 20 MPa at 28 days, flyash >25% of cementitious materials, nominal 20 mm aggregate, air 5-8%, slump 100 mm +/- 30 mm.
- Macro-fiber reinforcement: Fibremesh 650 engineered macro-synthetic fibers. Fibres capable to provide an average residual fiber reinforced concrete strength of 1.45 MPa. Minimum fibre reinforcement addition rate is 2.3 kg/m3 of concrete. Fibers to reduce temperature-induced cracking.
- Couldn't use steel fibre reinforcement because of public assess to concreted areas.

Photo Taken from Remote-Controlled Helicopter October 22, 2009

High Water Channel Drop #4 in Foreground; Drop #3L and #3R in Background

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Placing Boulder Concrete

Right Side of High Water Channel #3R

High Water Channel Drop #4 Looking Towards Deerfoot Trail

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Helicam Photo 092810

High Water Channel Drop #4

Inlet to the Low Water Channel

Low Water Channel Drop Structures

Low Water Channel – Helicam Photo

Weir Modifications (HWC Drop #1)

- Weir will remain after project is completed.
- Four notches cut in weir.
- Jet supported with 4 m long concrete fillet along back side of weir.

Existing Weir Looking Northeast (April 10, 2007)
Note: Water Diverted Through Sluiceway

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Current Photo of Weir Rehabilitation

Design and Construction Issues

- Claystone/Mudstone Bedrock
- Care of Water
- Ice
- Reducing Construction Impacts on Aquatic Environment

Claystone/Bedrock

- Encountered significant quantities of claystone under the river gravels.
- Material is too fine-grained for cofferdam construction (material specified to have less than 10% passing 200 sieve).
- Hauled to reclaim stockpile/work laydown area.

Construction Issues/Challenges

- **Care of Water**
  - The Bow River flows through the project site.
  - The Bow River has/will be diverted around the isolated construction areas during construction phases.
  - It is a requirement of the AENV Water Act Approval and the DFO Authorization that the Contractor's isolation plans be reviewed by DFO and AENV.
  - Instream construction is permitted from April 6th to April 30th and July 15th to September 15th each year. Cofferdam construction was permitted in December 2008 to February 2009 for construction of the fishway wall extension.
  - In winter 2008 dewatering activities for the fishway wall extension required 3- 10" diameter pumps. Water directed to settling pond. River gravels are very porous and productive. In 2009 and 2010, dewatering activities for HWC Drop Nos. 2L, 2R, 3L, 3R, and 4 required significantly less dewatering sumps and pumps due to claystone.
  - Comprehensive turbidity monitoring undertaken by the Contractor to assess impact of construction activities on downstream water quality.

River Diversion – July 2009 to April 2010

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Current River Diversion

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Construction Issues/Challenges

- **Ice**
  - Start of instream construction started on December 12, 2008.
  - Ice freeze up occurred on December 21, 2008.
  - Freeze up water levels increased approximately 1.2 m overnight.
  - Ice resulted in isolated pools that stranded fish. Contractor required to monitor water depths, dissolved oxygen, pH, conductivity, temperature to ensure fish could overwinter in these isolated pools.
  - Ice in cofferdams resulted in minor piping within the gravel cofferdams.

Christmas 2008!!!!!

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Construction Issues/Challenges

- Turbidity Monitoring
  - Monitoring with ice cover – safety issues; slush in water samples
  - Allowable increase over background TSS levels is 25 mg/L
- Fish Salvage/Entrapment
  - Fish salvage performed in isolated pools.
  - Six fish salvages thus far.

Fish Salvage at -15 deg C (i.e. times when I’m glad I’m not a fisheries biologist)

Project Overview - Quantities

- **Work includes:**
  - Common Excavation: 52,000 m^3
  - Random and Select Fill: 23,500 m^3
  - Bedding Gravel: 7,500 m^3
  - Riprap (all zones): 18,800 m^3
  - Boulders (all zones): 24,000 tonnes (1 m to 1.6 m diameter)
    - 7,000 rocks – 1 m diameter (approx. 1.4 tonnes) 7,000 Mini Coopers!!
    - 1,500 rocks – 1.3 m diameter (approx. 3 tonnes)
    - 300 rocks – 1.6 to 2 m diameter (approx. 6 tonnes)
  - Boulder Concrete: 4,000 m^3
  - Topsoil Placement (including imported): 12,000 m^3
  - Drill Seeding: 120,000 m^2
  - Pocket Plantings in Riprap: 5,000

Boulder Counts/Sizing

Project Status

- Fishway wall extension completed and portion of 1912 weir slab removed.
- High Water Channel Drops #2L, #2R, #3L, #3R, and #4 are completed.
- Low Water Channel is completed.
- Modifications to the weir are completed.
- Tile drain and extension of fish hatchery effluent pipelines completed.
- Project is on schedule and under budget.
- Construction completed by April 2011; however, depending on regulatory approvals and project commissioning, project may not be open to public boat traffic till spring 2012.

Project Commissioning Completed to Date

- River conveyed over HWC Drops #3L, #3R and #4 since April 15, 2010.
- Initial commissioning (i.e. kayaks, canoes, dingies, floaties, and swimmers) performed on April 21, 2010.
- Public invited (Alberta Whitewater Association, Bow River Canoe Club, Calgary Fire Department, river surfers, individuals) invited on site on June 2, 2010.

Project Commissioning Completed to Date (Cont'd)

- No keeper waves or "holes". Swimmers in PFDs float through site.
- Refuge boulders are important to allow weaker swimmers to seek refuge.

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Questions?