Urban Stream Restoration and Infrastructure Repair at Tideman Johnson Park on Johnson Creek, Portland, Oregon

Presented By: Paul Agrimis, RLA, PE, PWS

VIGIL-AGRIMIS, INC.

ENVIRONMENTAL SERVICES
CITY OF PORTLAND

HERRERA ENVIRONMENTAL CONSULTANTS

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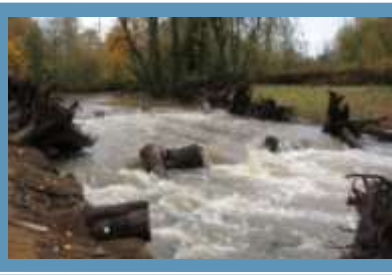
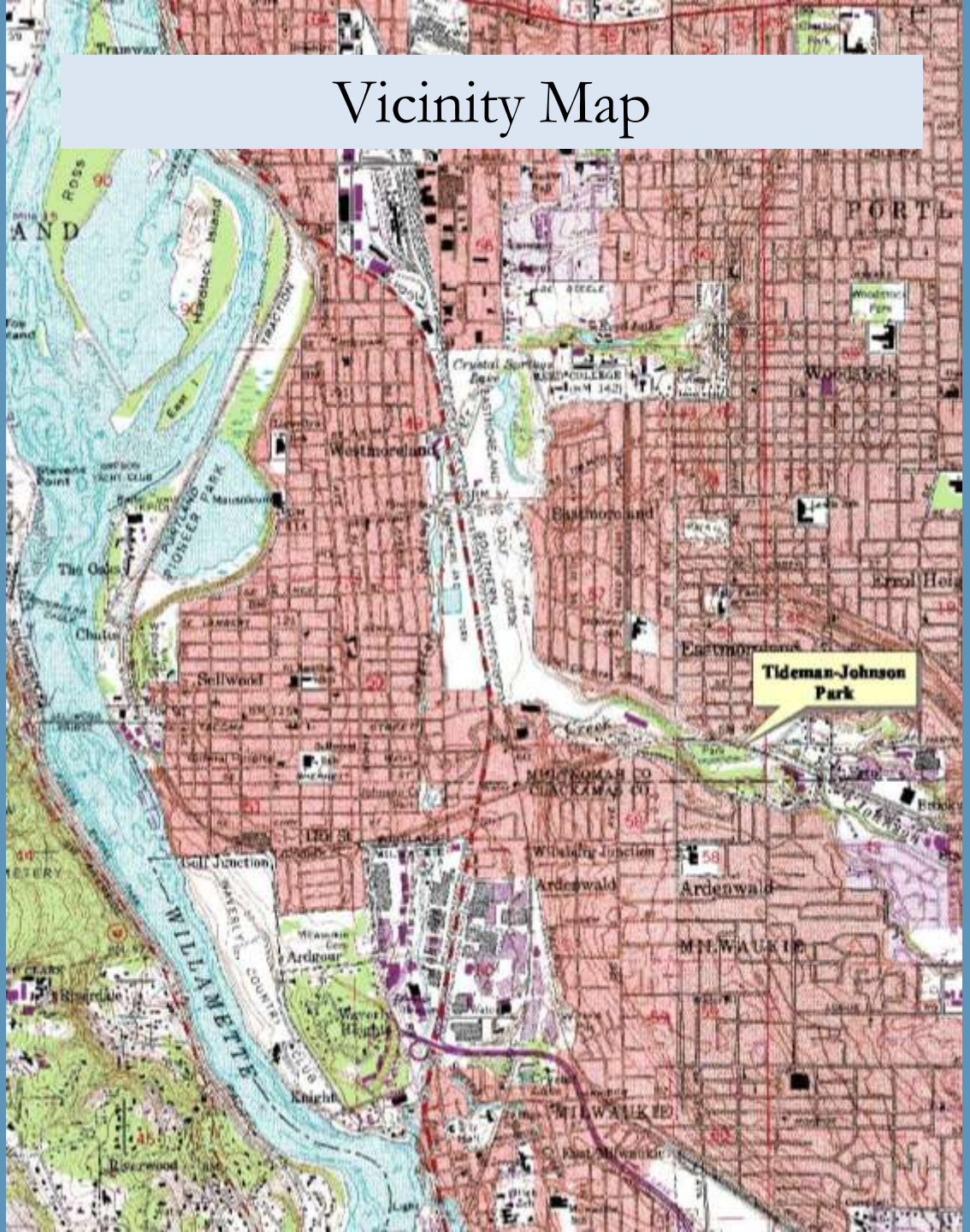
Tideman Johnson Park Stream Restoration
Key Team Members

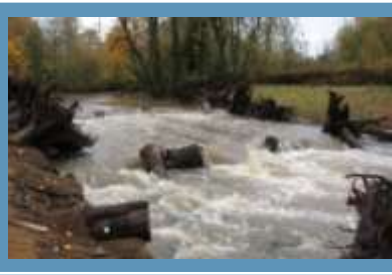


- Scott Clement, P.E., Maggie Skenderian
  - City of Portland, Bureau of Environmental Services
  - Project Manager, Johnson Creek Watershed Planner
- Paul Agrimis, R.L.A., P.E., P.W.S., Ken Vigil, P.E.
  - Vigil-Agrimis, Inc. Project Manager, Engineering Task Leader
- Matt Brennan, P.E. and Tim Abbe, R.G.
  - Herrera Environmental Consultants
  - Engineered Log Jam Task Leader; Geomorphology Task Leader
- Portland Parks
- Brant Construction

Vicinity Map

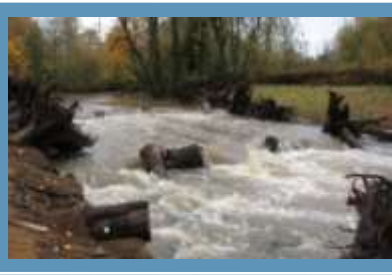


Presenting Issues for Tideman Johnson Park Stream Restoration



1. Channel incision of up to seven feet since 1923 along 1,600+ feet of urban Johnson Creek in Tideman Johnson Park exposed 57”x 61” brick lined trunk sewer.
2. Siphon bypass and other traditional infrastructure solutions estimated to cost $2.5 -$4 million, only $1.5 million available for construction.
3. Former floodplain mostly functioning as terrace; largely not accessible during most peak events
4. Bed and bank erosion had simplified aquatic habitat.
5. Riparian habitat suffered from limited stream interaction and overuse by visitors.
6. Frequent peak events and little large sediment recruitment.

Project Goals for Tideman Johnson Park Stream Restoration



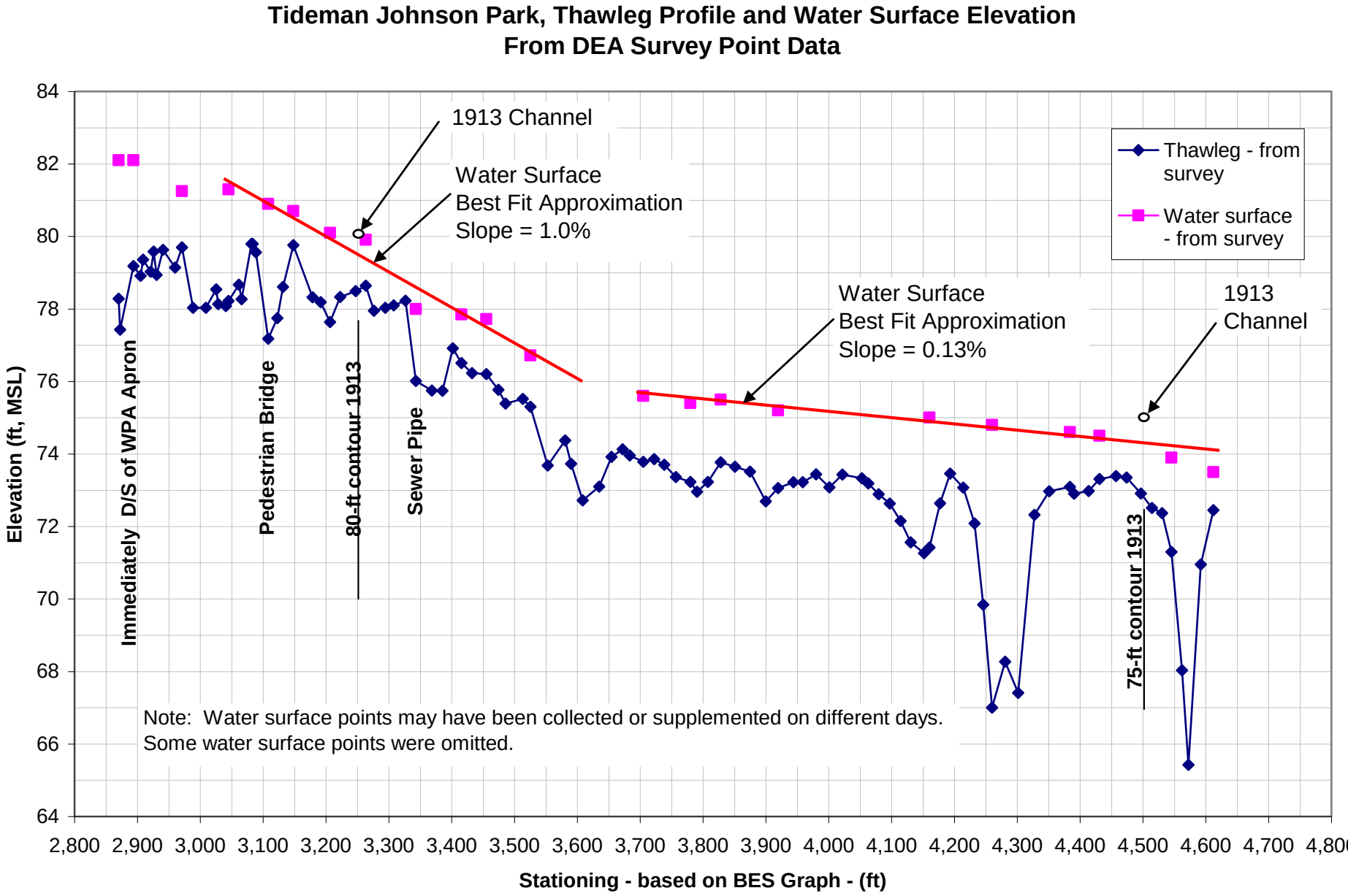
1. Protect a major trunk sewer for SE Portland made vulnerable by stream incision
2. Reestablish a functioning stream/floodplain system
3. Enhance aquatic and riparian habitat
4. Upgrade a popular park

Trunk Sewer as grade control in March 2004

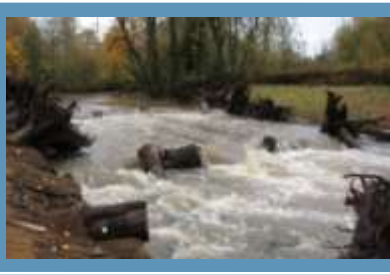
Upstream armoring and LWD

Tideman Johnson Park upstream reach in 1934

May 1936 Aerial Photo


Tideman Johnson Park, Thawleg Profile and Water Surface Elevation
From DEA Survey Point Data
Elevation (ft, MSL)
84
82
80
78
76
74
72
70
68
66
64
2,800
2,900
3,000
3,100
3,200
3,300
3,400
3,500
3,600
3,700
3,800
3,900
4,000
4,100
4,200
4,300
4,400
4,500
4,600
4,700
4,800
Stationing - based on BES Graph - (ft)
1913 Channel
Water Surface
Best Fit Approximation
Slope = 1.0%
Water Surface
Best Fit Approximation
Slope = 0.13%
1913
Channel
Thawleg - from survey
Water surface - from survey
Immediately D/S of WPA Apron
Pedestrian Bridge
80-ft contour 1913
Sewer Pipe
75-ft contour 1913
Note: Water surface points may have been collected or supplemented on different days.
Some water surface points were omitted.

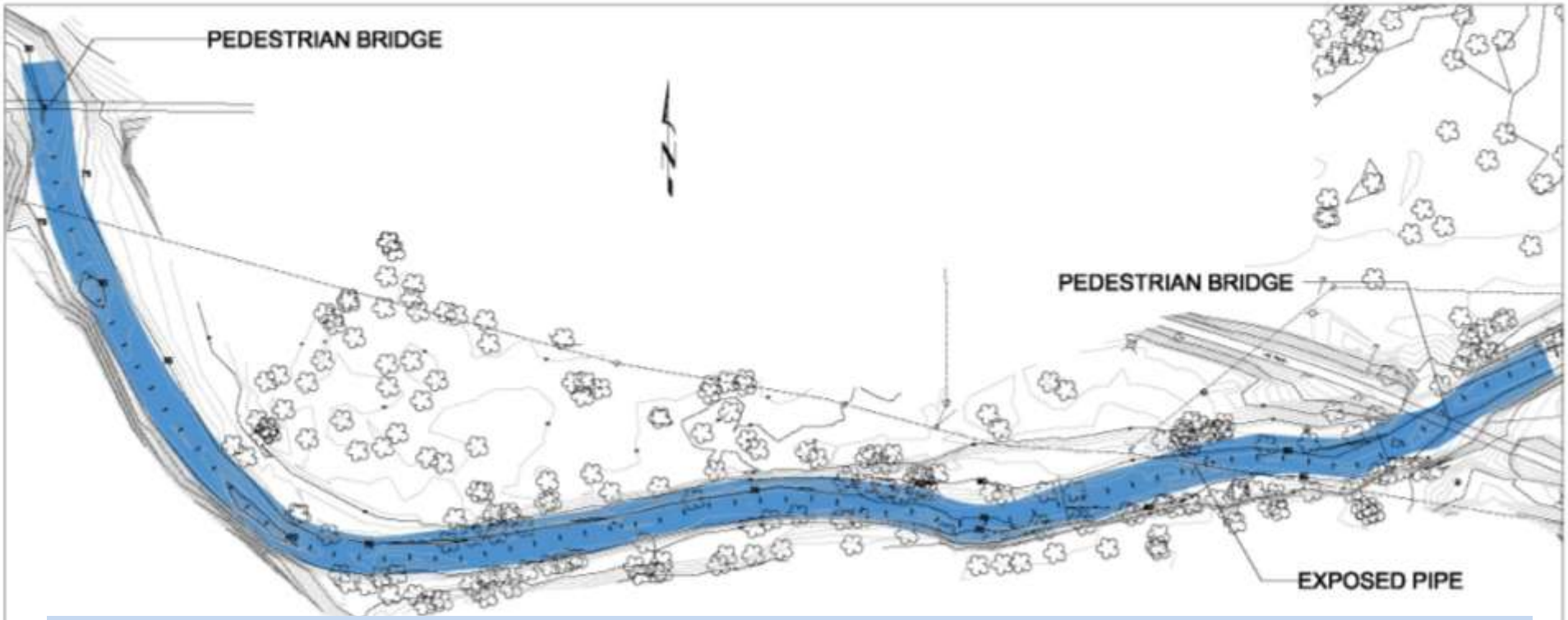
Project Concepts to Address Project Goals for Tideman Johnson Park Stream Restoration



1. Aggrade Johnson Creek to cover trunk sewer (Protect major trunk sewer)
2. Excavate Terrace to function as Floodplain (Reestablish stream/floodplain connection)
3. Add in-channel and off-channel complexity and sinuosity (Enhance aquatic and riparian habitat functions)
4. Add view platforms, define trail, discourage trampling of riparian zone (Upgrade a popular park)

Log jam model - Tim Abbe Photo

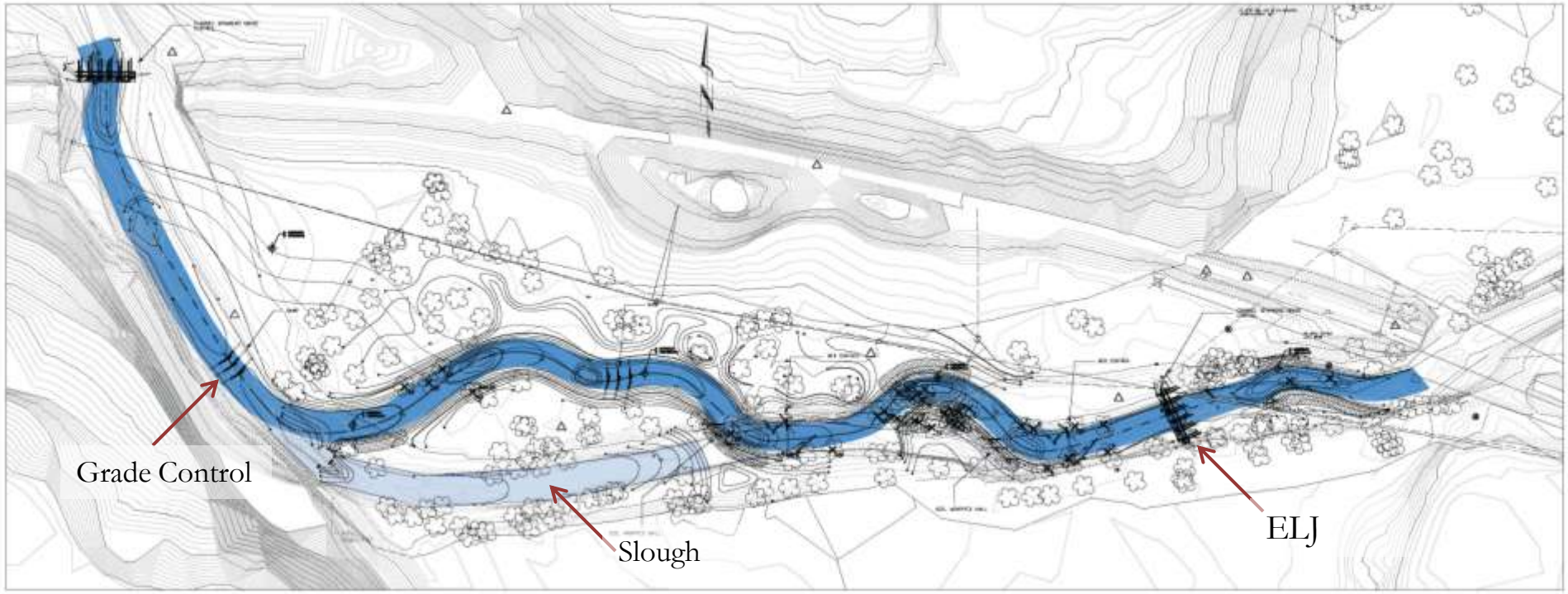
Tideman Johnson Park 2004 Surveys



Confirm Channel Properties and Identify Key Trees

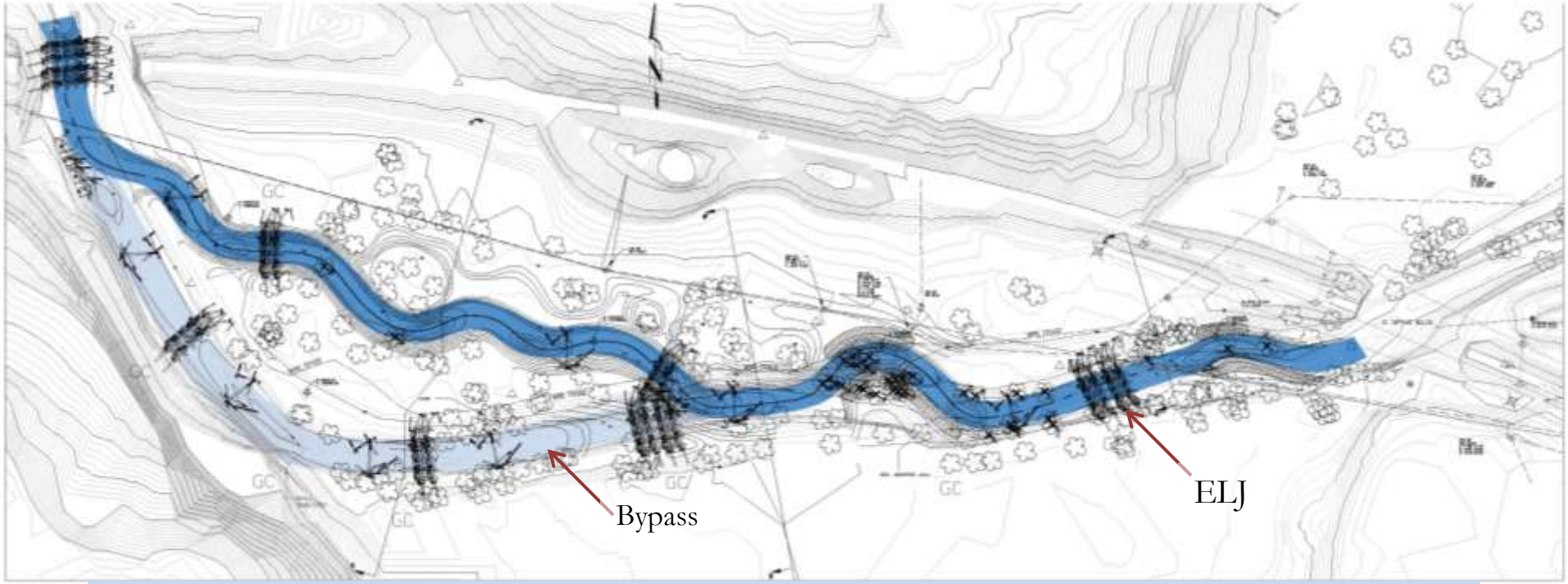
- Existing Sinuosity 1.06; 1913/1936 Sinuosity 1.09
- Existing W_{BF} – 40 ft; D_{BF} – 3.5 ft; W/D=11; W_{FP}/D~1.3
- Existing pool spacing - 143 ft/length – 86 ft
- Existing riffle spacing -136ft/length – 37 ft

Conceptual Grading Alternative 1



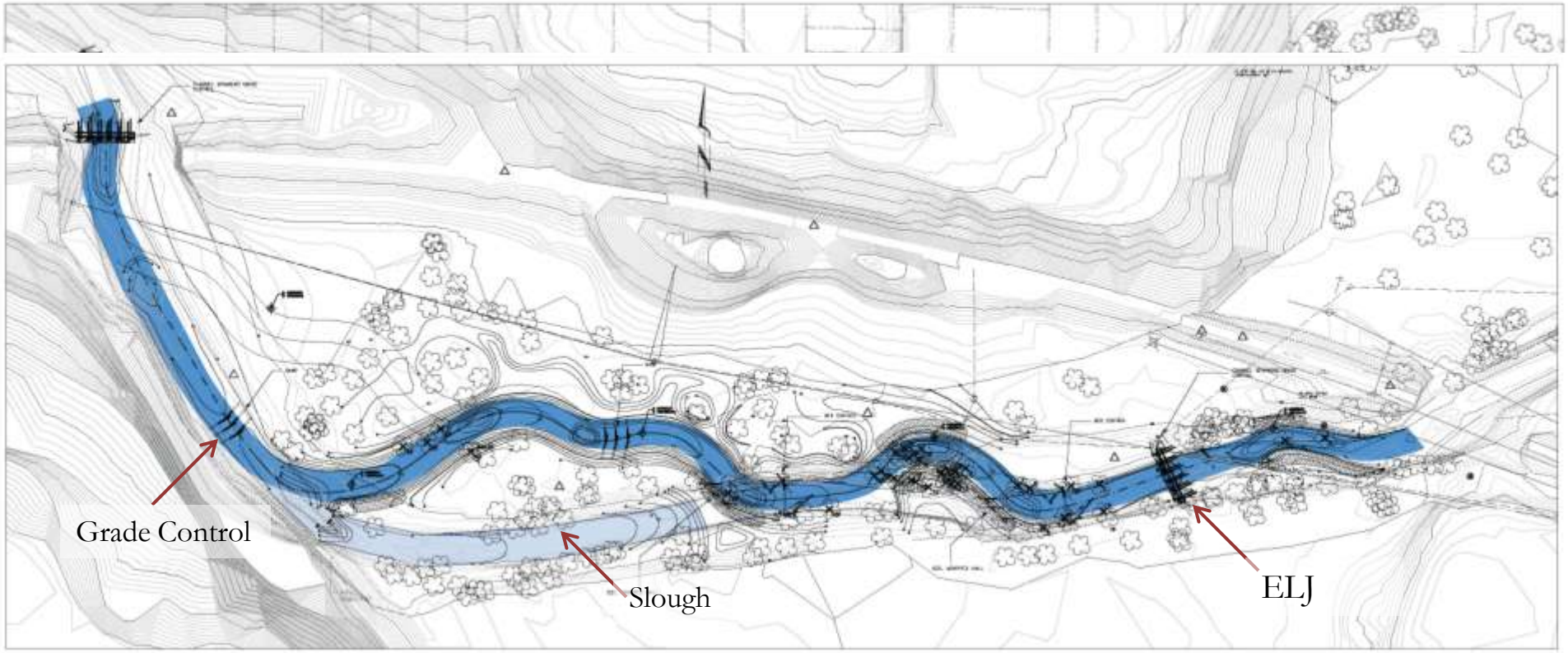
- New alignment & backwater slough
- 2 ELJs & 3 wood grade control structures
- Additional in-channel wood and anchor rock

Conceptual Grading Alternative 2B



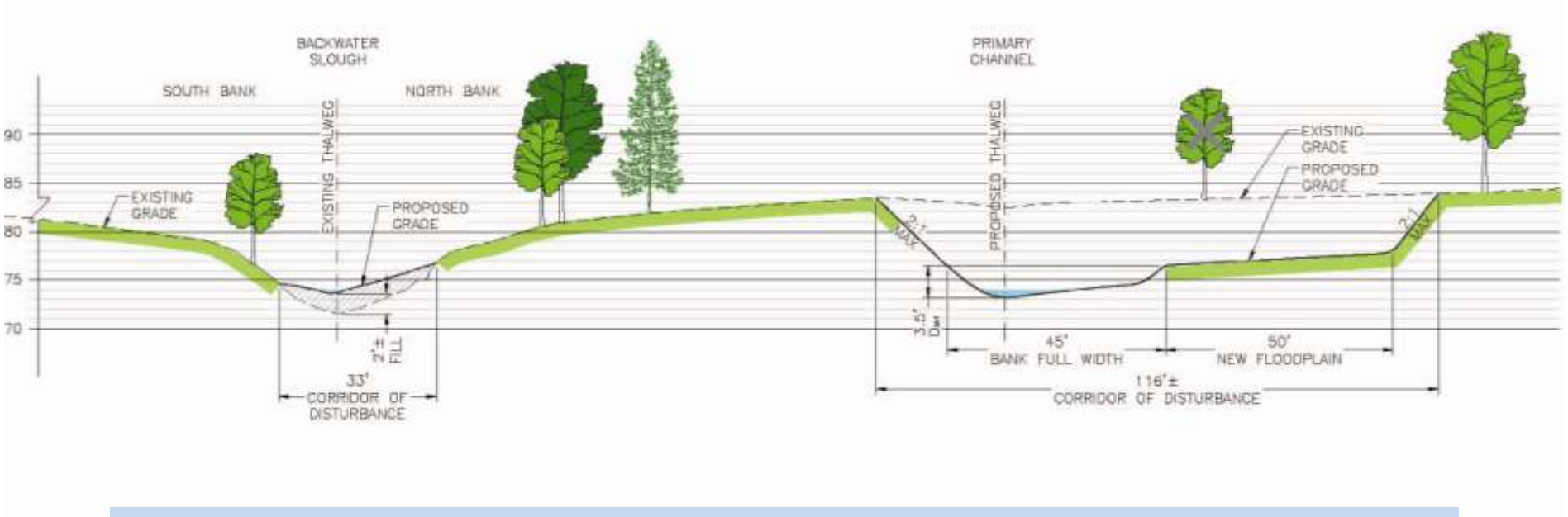
- New alignment and high flow bypass channel
- 2 Double ELJs & 4 ELJs
- Additional in-channel wood and anchor rock

Conceptual Grading Alternative 3



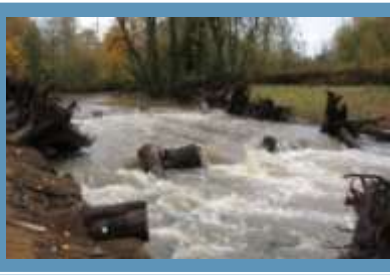
- New alignment & backwater slough
- 2 double ELJs & 2 wood grade control structures
- Additional in-channel wood and anchor rock

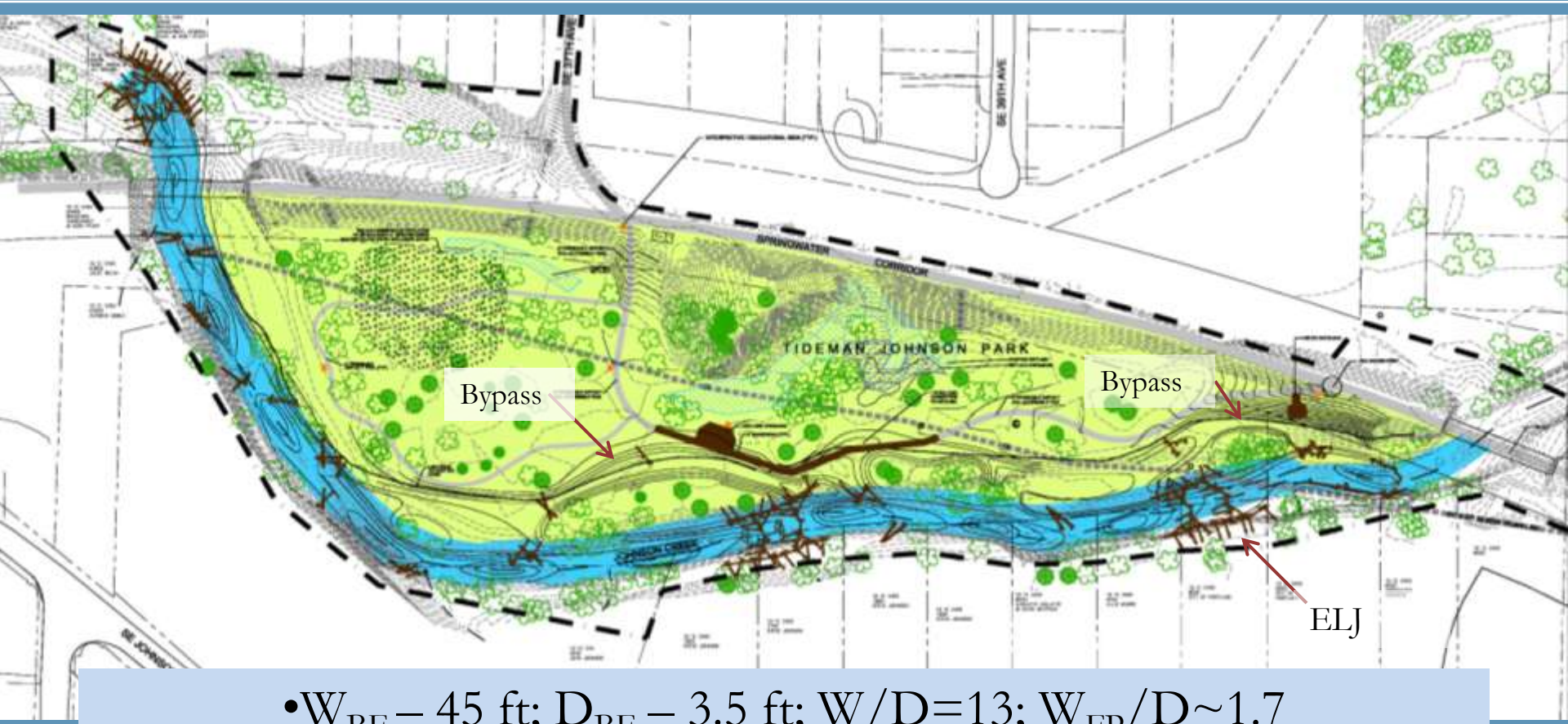
Alternative 3 Representative Section



- W_{BF} increased 12% to 45 ft
- D_{BF} maintained at 3.5 ft
- Floodplain expanded ~30-120%

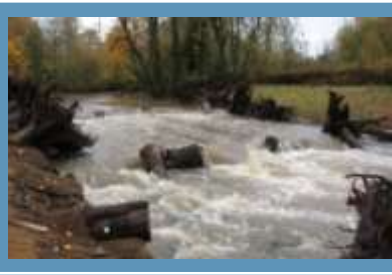
Site Plan for Selected Alternative





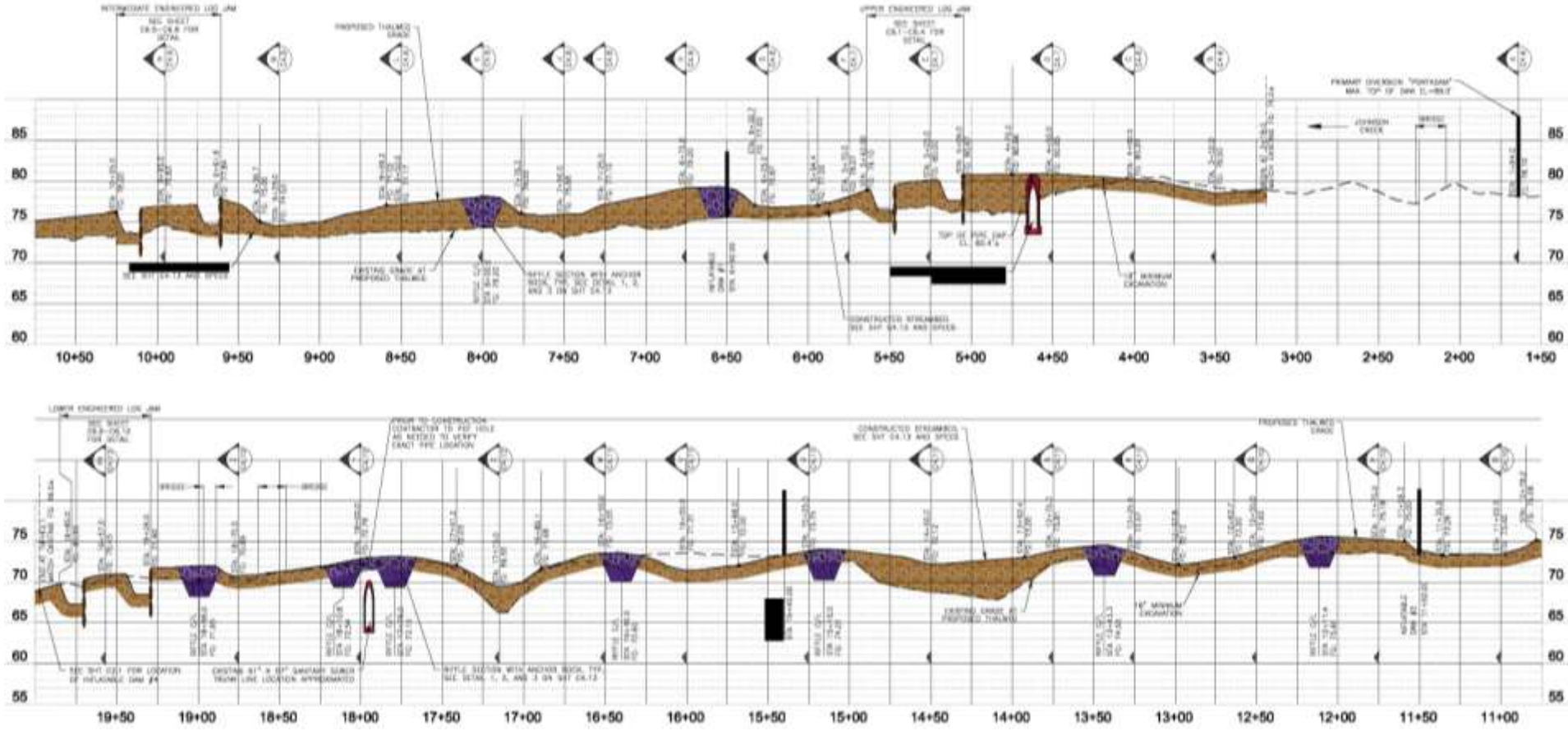
- W_{BF} – 45 ft; D_{BF} – 3.5 ft; W/D=13; W_{FP}/D~1.7
- Upper and Lower Bypass Channels added (~1,200 ft); S>1.2
- 3 ELJs & additional in-channel wood and anchor rock

Sediment Transport Analysis & Resulting Stream Materials Specifications

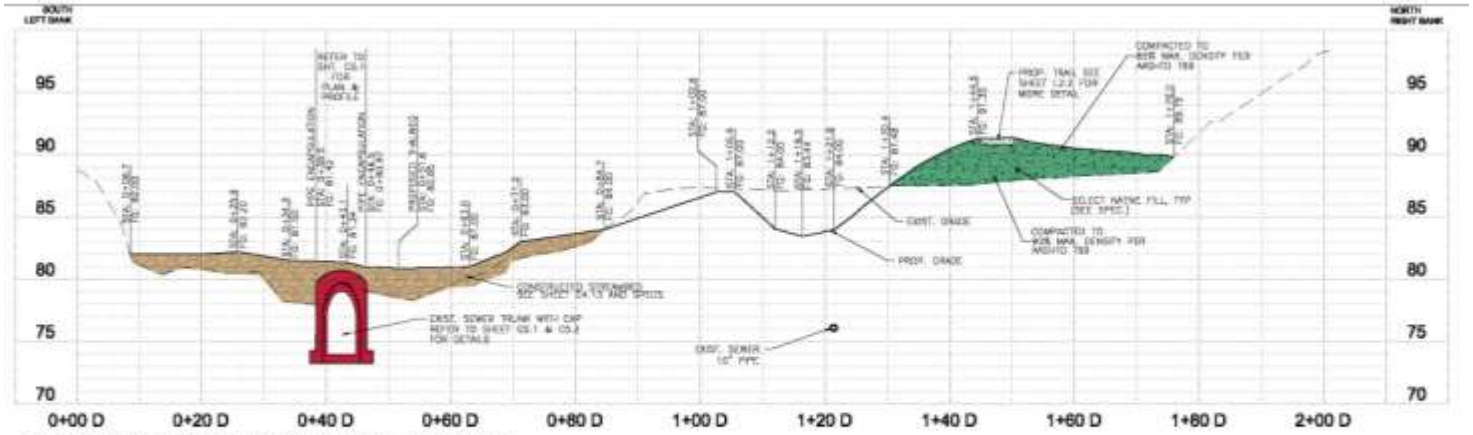


Percent Finer by Weight	Existing Bar Particle Distribution (Subsurface)	Existing Bar Particle Distribution (Surface)	Proposed Fines	Proposed Fish Cobble Mix	Proposed Fish Rock	Proposed Anchor Rock
D_0 (mm)	<2	<2	~0.1	19	410	910
D_{50} (mm)	9	44	~0.8	150	610	1070
D_{100} (mm)	110	170	19	300	810	1220

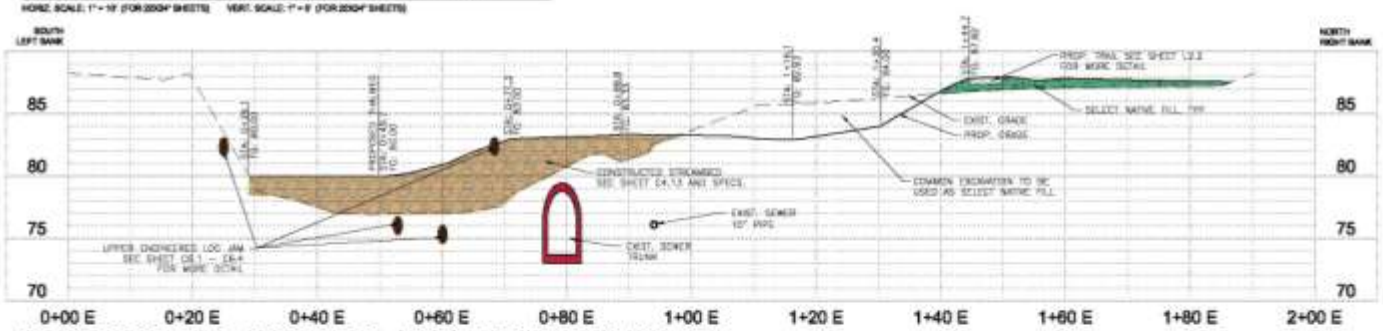
Proposed Stream Profile Along Thalweg



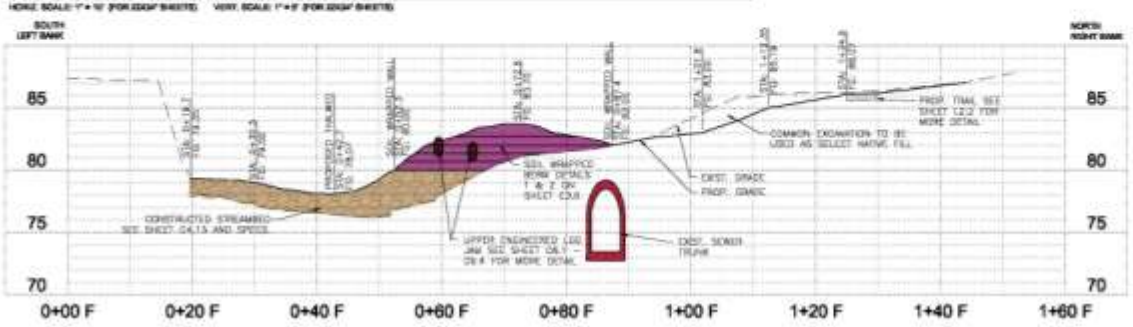
Selected Channel Cross Sections



CROSS SECTION D - AT STA: 4+50 - PIPE CAP

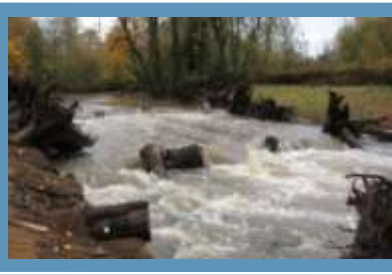


CROSS SECTION E - AT STA: 5+25 - UPPER ENGINEERED LOG JAM

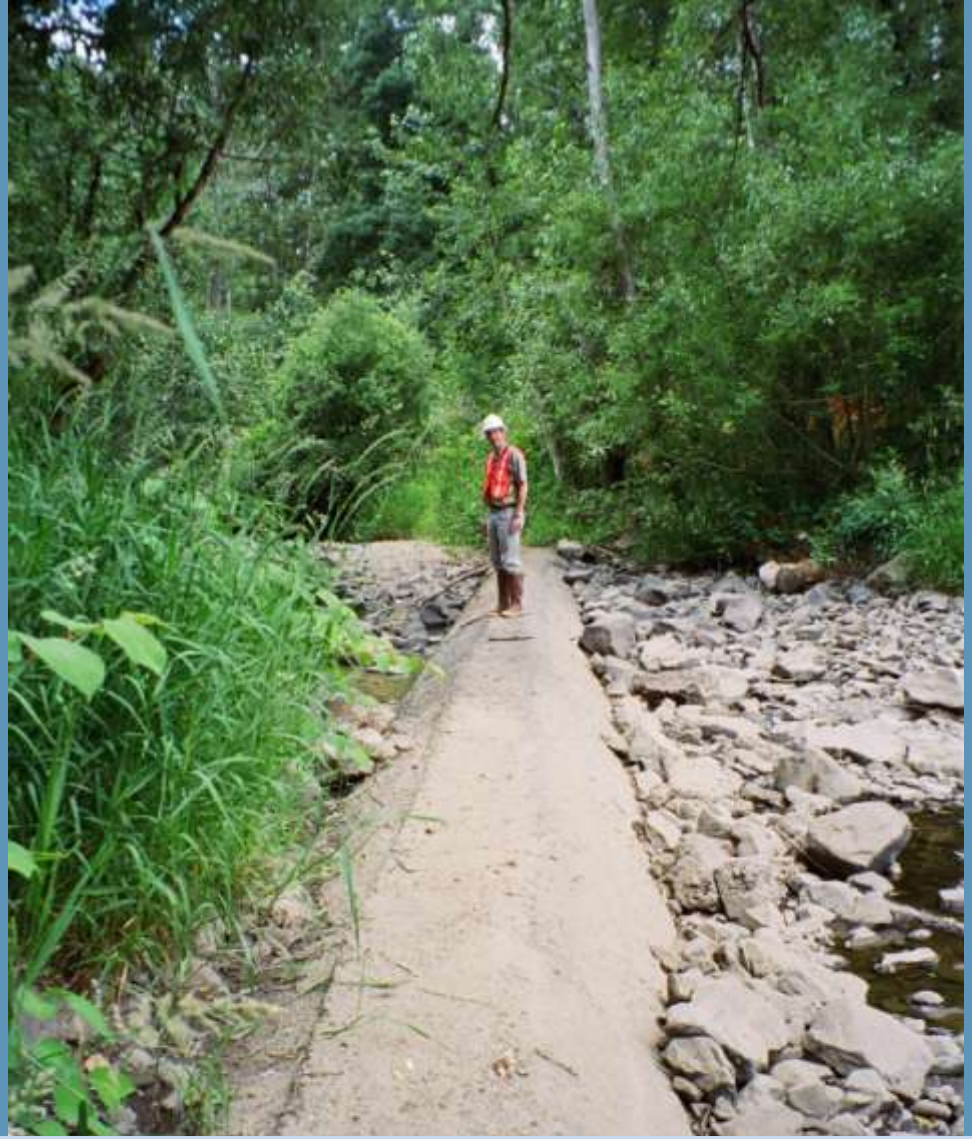


CROSS SECTION F - AT STA: 5+75 - TRANSITION

Key Stream Restoration Project Elements



- 3,400 CY Select Native Fill Excavation
- 2,400 SF Soil Wrapped Wall
- 97 Tons Imported Anchor Rock Boulders
- 58 Tons Imported Fish Rock
- 3,000 CY Fish Cobble Mix
- Upper, Intermediate, and Lower ELJs
- 18 Salvaged logs and root wads (in-channel)
- 31 Imported logs and root wads (in-channel)
- 13 Salvaged logs and root wads (upland)



Trunk sewer exposed after dewatering – June 2006

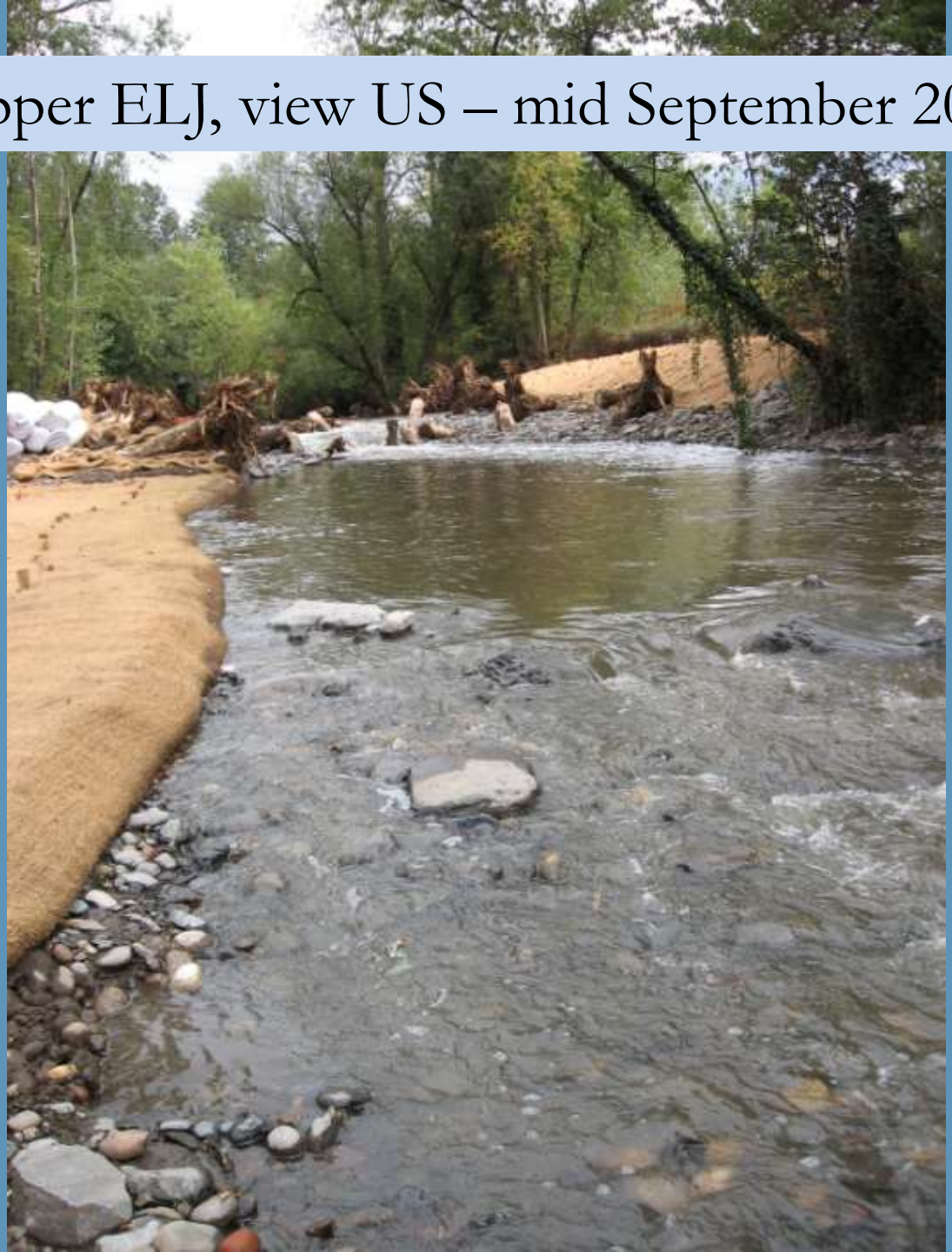
Excavation for trunk sewer pipe cap – June 2006

Completed trunk sewer pipe cap – June 2006

Mining of Select Native Fill from terrace – June 2006

Construction of Upper ELJ, view US – August 2006

Upper ELJ, view US – mid September 2006



Beaver modifications to Upper ELJ – late September 2006

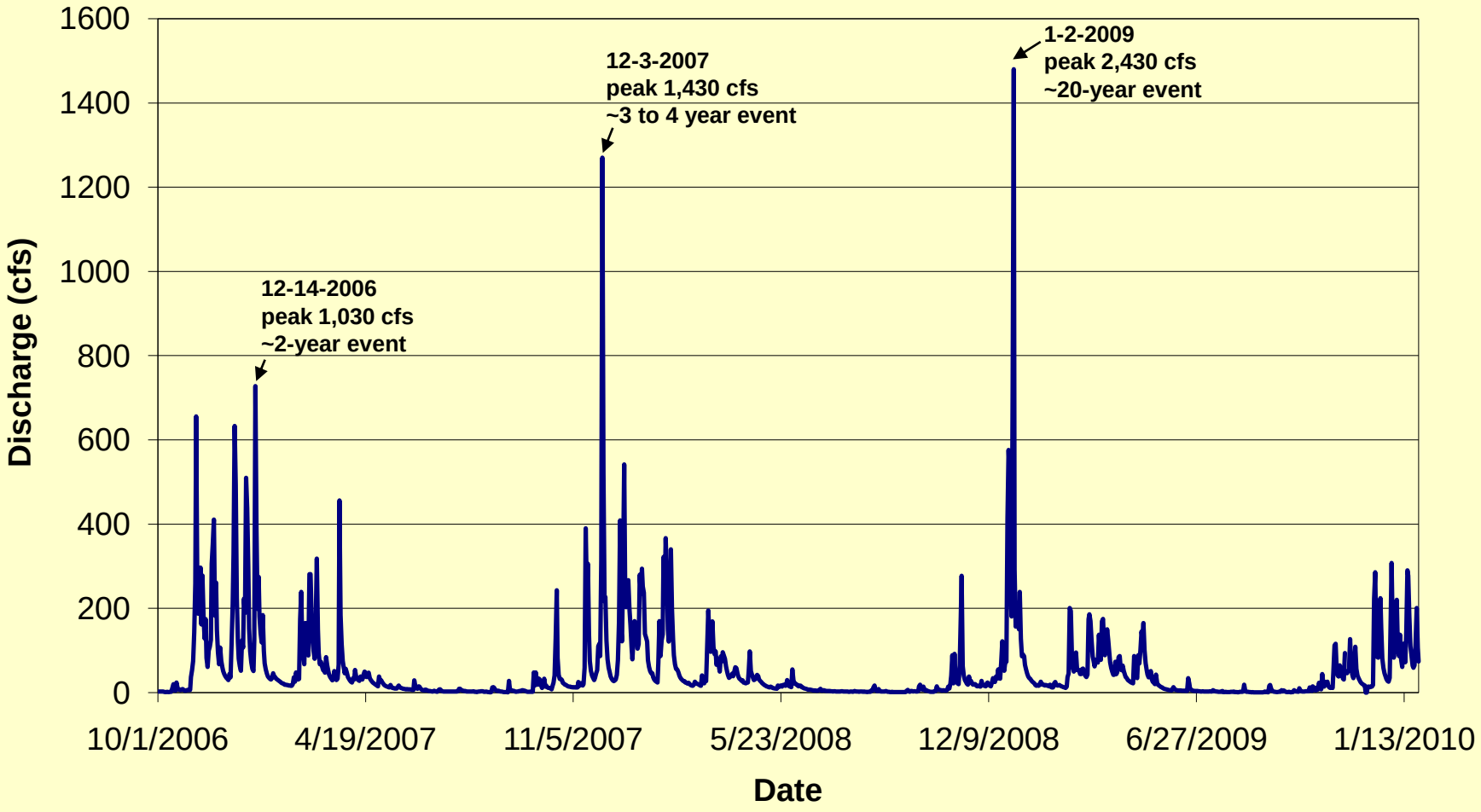
Construction of Middle ELJ, view DS – June 2006

Construction of Middle ELJ, view DS – June 2006

Middle ELJ, view DS – September 2006

Lower ELJ, view US – August 2006

Mean Daily Discharge, Johnson Creek at Sycamore, Oregon, USGS 14211500
October 1, 2006 through January 27, 2010



Lower Bypass Channel during peak, view US – November 2006

Lower Bypass Channel during peak, view DS – November 2006

Erosion at DS end of Lower Bypass, view DS – November 2006

Erosion at DS end of Lower Bypass, view DS – November 2006

Erosion at DS End of Lower Bypass, view US – November 2006

Bank Erosion RB at Lower ELJ, view DS – November 2006

Upper Bypass engaged during peak, view US – December 2007

Lower Bypass engaged during peak, view US – December 2007

Lower ELJ during peak, view DS – December 2007

Racked up debris LB at Lower ELJ, view DS – February 2008

Cut Logs in Lower ELJ – July 2008

Minor bank erosion at Lower ELJ LB, view DS – January 2010

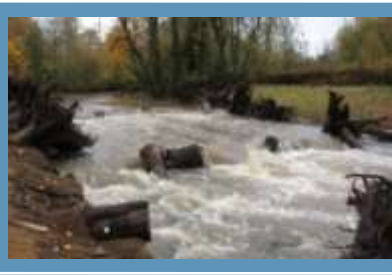
Racked up debris Lower Bypass, view DS – January 2010

Wood element channel constriction scour Lower Bypass – January 2010

Racked up debris Upper ELJ RB, view DS – January 2010

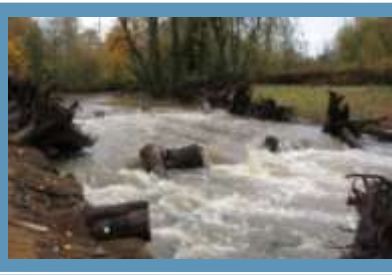
Bank erosion at Upper ELJ LB, view DS – January 2010

Tideman Johnson Park
Stream Restoration Conclusions



1. Trunk sewer appears very well protected.
2. Stream aggradation and terrace cut are working very well to establish and maintain a functioning stream/floodplain system.
3. Aquatic and riparian habitat have been markedly enhanced by additional structure and complexity.
4. Trails, boardwalk, viewpoint, and fencing have provided valuable upgrades to a popular park.
5. Regular monitoring and adaptive management necessary.

Tideman Johnson Park
Stream Restoration Lessons



1. Borrowing liberally from Tip O'Neil ~ "All shear stress is local shear stress."
2. The continuity equation (Q=A*V) is your friend.
3. Beavers may not be your friend.
4. Urban debris may not be your friend either.
5. Monitoring and maintenance are essential for the first few years after a project, and are important to support greenfrastructure function going forward (just as one would expect with traditional infrastructure).

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