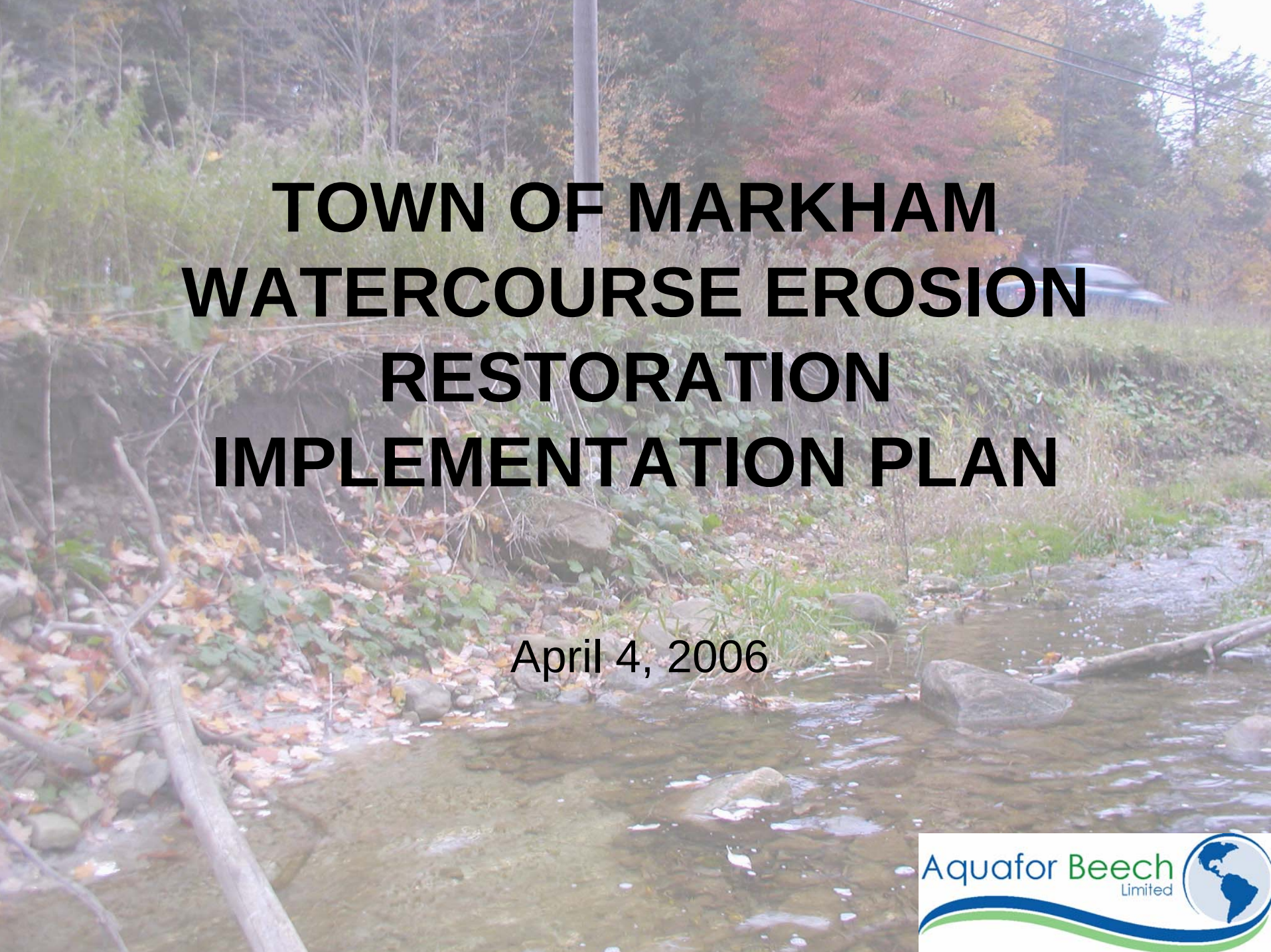


TOWN OF MARKHAM WATERCOURSE EROSION RESTORATION IMPLEMENTATION PLAN

April 4, 2006

Aquafor Beech Limited

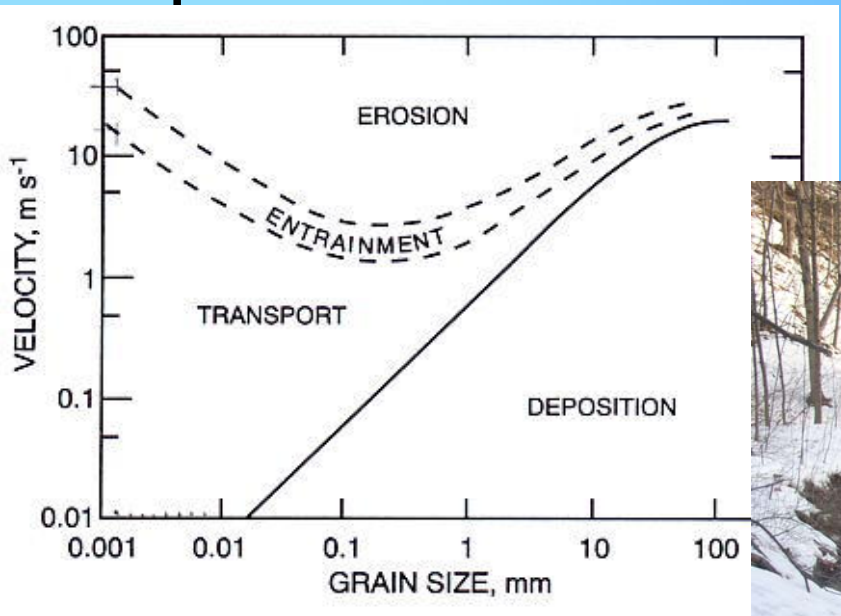
Study Objective

- To protect public health and safety by developing an implementation plan for erosion sites:
  - Identify worst sites
  - Identify priority sites for restoration
  - Monitor remaining sites

Erosion Concepts

- Erosion is a normal aspect of river behavior
- Channel function involves conveying water and sediment to larger bodies of water
- Objective of stormwater management is to maintain a level of stream erosion such that the channel can continue to fulfill its normal function

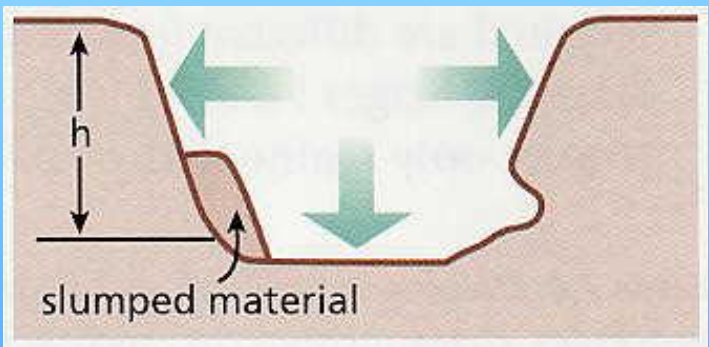
- Processes: Erosion, Transport, Deposition



Modes of Channel Change

WIDENING:

- Enlargement to increase capacity



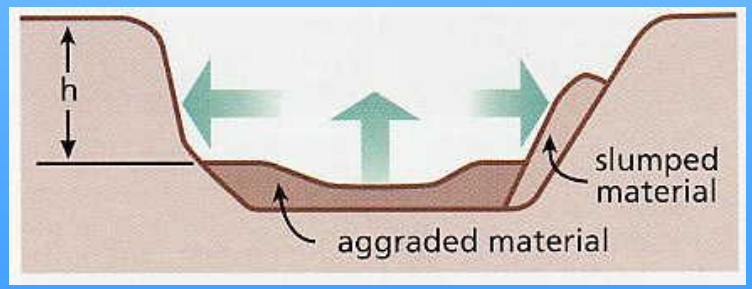
MIGRATION:

- Movement of channel on floodplain

All components of channel form are intrinsically linked – a change in one parameter (e.g., width) will cause changes in other parameters (planform geometry)

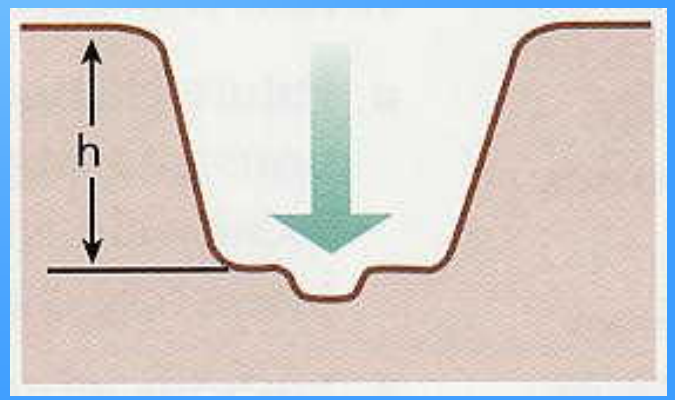
AGGRADATION:

- Excess sediment loading



DEGRADATION:

- Lowering of channel bed

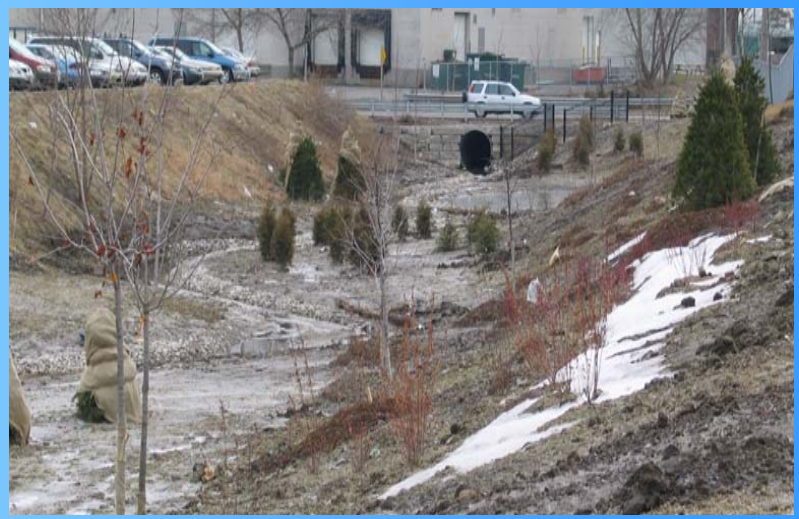


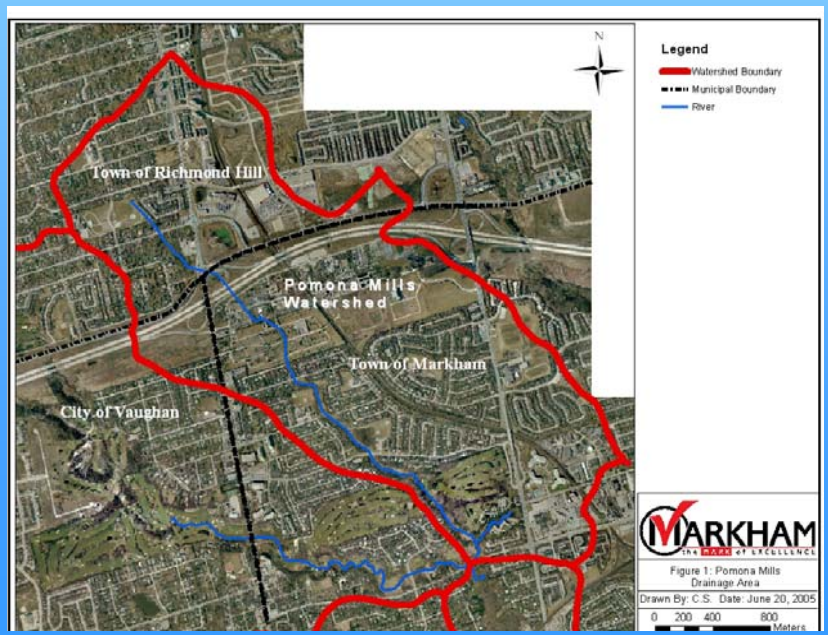
History

- Erosion studies previously completed in 1996 and 2004 as part of the Development Charges Background Study
- Erosion studies identified existing and future erosion in watercourse in public and private lands
- Engineering department yearly capital budget have included allowance to remediate erosion sites, and retrofit stormwater management facilities

Recent Erosion Remediation Projects

Upper Milne Creek Restoration
(Construction completed 2005)



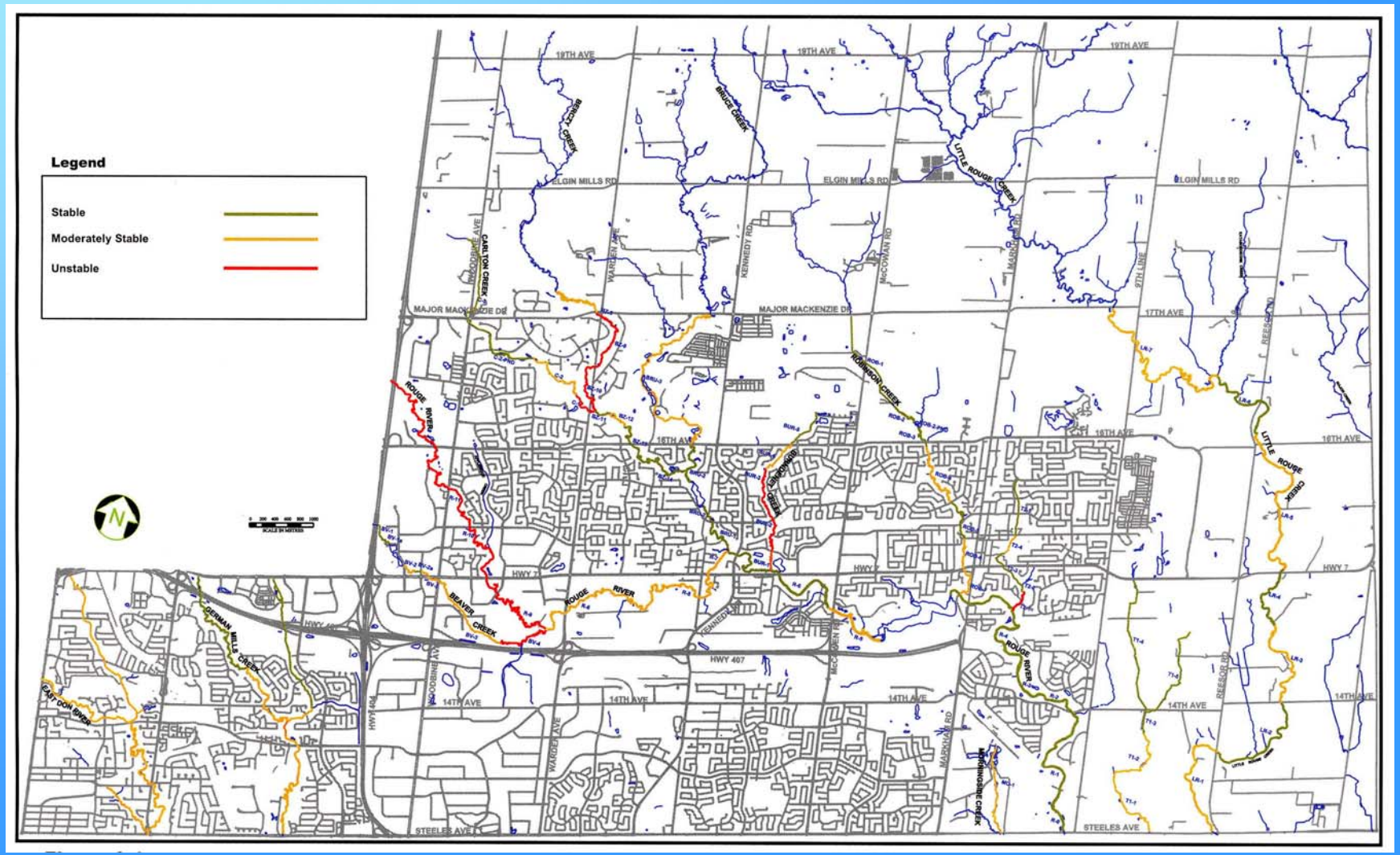


Pomona Mills Creek Erosion Restoration & Habitat Enhancement
(Ongoing Study)

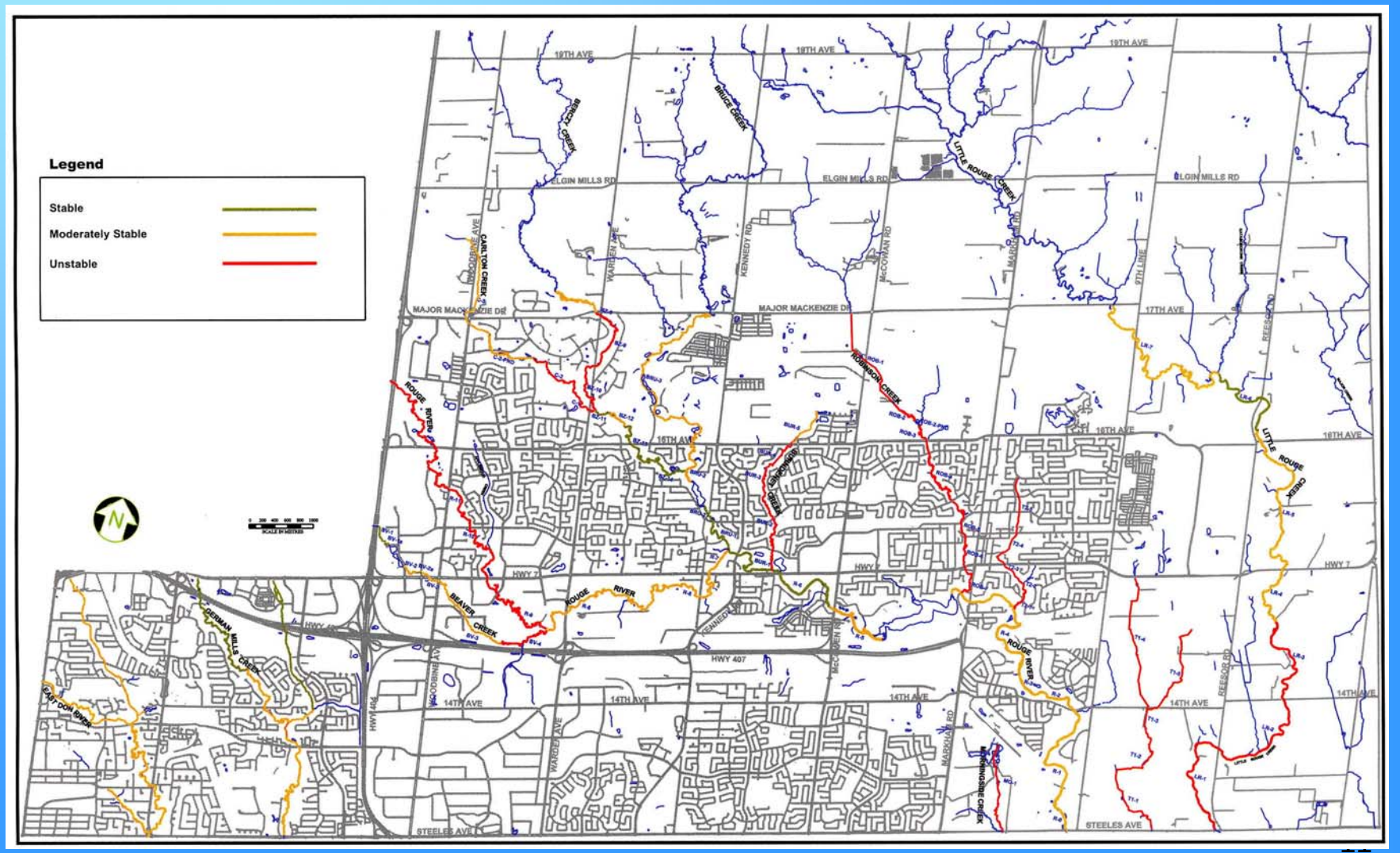
Cost Implications

- Approx. costs identified in 2004 to address erosion:
  - Existing conditions = $ 20 million
  - Future conditions = $ 45 million
  - Funding requirement included in the 2004 DC bylaw are $ 44.6 million
    - Local cost (Developers) = $ 11.0 million
    - Town wide hard cost = $ 18.0 million
    - Non growth cost = $ 15.6 million
  - Funding strategy and opportunities with environmental agencies/interest groups will continue to be pursued (i.e. Great Lakes Renewal Fund, TCA, MNR, Rouge Park Alliance, etc.)

Existing Stream Conditions - 2004



Future Stream Conditions



Representative Problem Areas

- This study has prioritized, and updated the cost estimates for proposed works
- Study has been structured as an Environmental Assessment Study so individual Environmental Assessment for each site are not required
- Undertaken field inventory for all watercourses
- Identified >300 erosion sites
  - More sites in older areas
- Identified ~ 60 potential fish barriers

Types of Problems Due to Erosion

- A) Risk to Public (property, roads, pathways, bridges)
- B) Risk to Structures (sewer pipes, outfalls, manholes etc.)
- C) Risk to Fisheries (focus on barriers)
- D) Maintenance (gabions, culverts etc.)

Risk to Public


Warden Avenue


Parking lot – German Mills Creek


Pomona Creek


East Don Tributary

Risk to Structures


East Don River Tributary


Mount Joy Creek


German Mills Creek


German Mills Creek

Risk to Fisheries

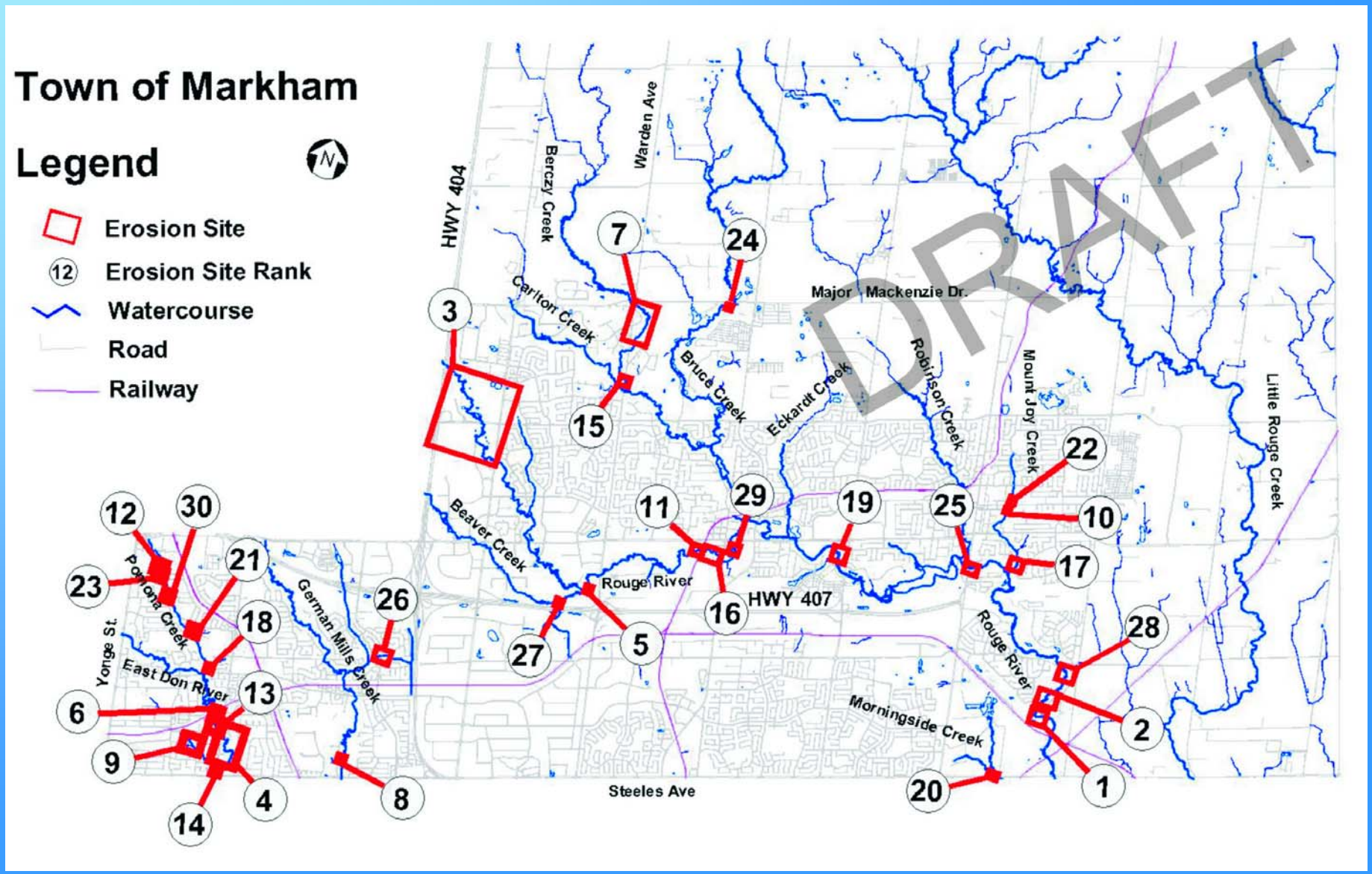
- Pomona Mills Creek

- Bruce Creek

Evaluation Process

- Objective: evaluate severity of each site prioritize each site based on:
  - Public health and safety
  - Erosion index
  - Natural resources risk

Erosion Site Map



Erosion Site Photos

Private Property

Erosion Site Photos

Infrastructure / Parking Lots (Private Property)

Prioritization of Sites - DRAFT

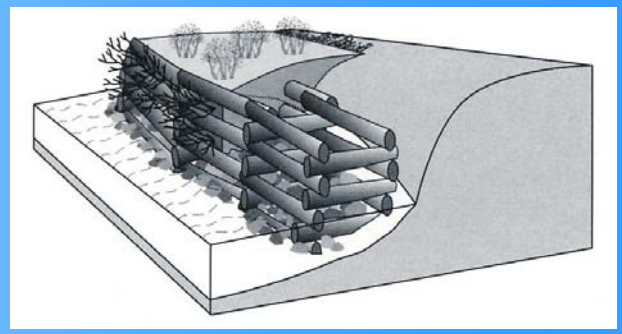
Site/ Location	Problem	Restoration Measure	Future Requirements	Cost
Rouge River, Parkview Golf Course	Valley wall erosion into golf course green	Regrading of slope with plantings, buffer zone and toe protection	Recommend riparian buffers throughout golf course	$360,000
Rouge River, South of 14th Ave.	Valley wall erosion into private property on Rouge River	Flow deflection with some regrading, plantings and buffer	Monitoring	$180,000
Rouge River, Markham Golf Club	Widespread bank erosion throughout golf course	Plantings and buffer zone establishment	Recommend riparian buffers throughout golf course	$550,000
East Don River, North of Steeles Ave.	Widespread bank erosion and failing protection measures within private property	Removal of debris, bank treatments and plantings, maintenance of existing protection	Future monitoring and watercourse study. Upstream stormwater management.	$1,000,000
Rouge River, West of Warden Ave.	Unstable slope and toe erosion adjacent to private parking lot	Flow deflection with toe protection such as crib-walls. Slope plantings.	Monitoring	$180,000

Restoration Concepts - Example Site

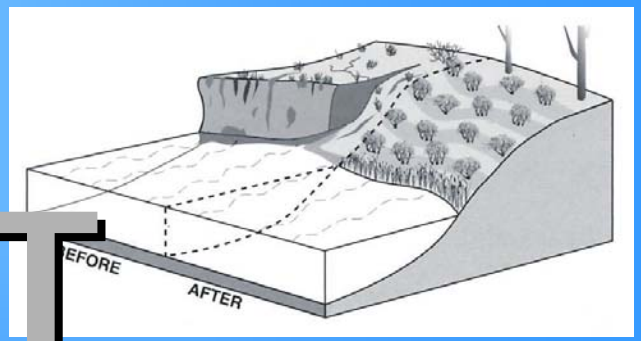
- Associated costs
- $100,000

DRAFT

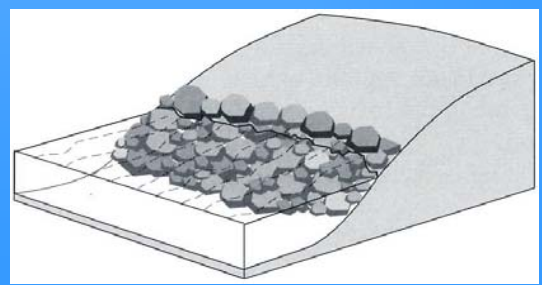
1 Live (Vegetated) Cribwalls



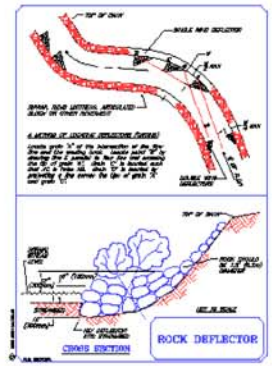
2 Bank Shaping & Planting

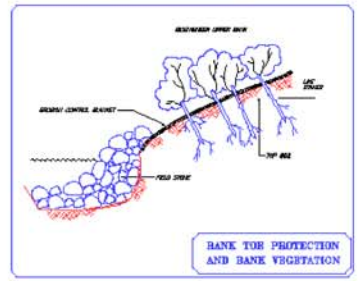


Stone Toe Protection



Example concept – to be updated with actual top 30 site





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To be tabled on April 4th

- VALLEY WALL CONTACTS
- SLOPE TOE PROTECTION
- ESTABLISH VEGETATION ON SLOPE
- ALLOW FOR NATURAL MIGRATION AND WIDENING TENDENCIES

- BANK EROSION
- ENHANCE VEGETATION AT CREST OF BANK
- TOE PROTECTION
- RE-ORIENT THALWEG
- ENHANCE AQUATIC HABITAT
- REPLACE GABIONS WITH SOFTER TECHNIQUE WHERE POSSIBLE
- MONITOR EXISTING EROSION SITES
- ALLOW FOR NATURAL MIGRATION AND WIDENING TENDENCIES

TOWN OF MARKHAM

PROJECT:
TOWN OF MARKHAM
EROSION RESTORATION
IMPLEMENTATION PLAN

Aquafor Beech

WATERCOURSE: EAST DON RIVER
REACH: ED-1 FIGURE: 3
AQUAFOR PROJECT NO.: 64550

LOCATION:
BAYVIEW AVENUE TO
DOWNSTREAM CONFLUENCE

SCALE 1:5,000

East Don River

Steeles and Bayview area

Implementation

An implementation plan will be developed which will:

- Prioritize when and where works need to be undertaken
- Define approximate costs to undertake the works
- Summarize future design and approval requirements

Next Steps

- Hold Public Information Center – April 26 2006, Canada Room
  7:00 p.m. to 9:00 p.m.
- Finalize Report – May 2006
- Incorporate updated cost estimates in Development Charges Update - May 2006
- Staff Report to Council – June 20, 2006
- File EA Report – July 2006
- Proceed with capital program (± $1 million)
  late 2006/early 2007 on priority sites
- Update to watercourse erosion restoration implementation plan every 4 years in association with development charges background study
- Coordinate erosion implementation plan with operations and asset management department study for August 19, 2005 storm event.