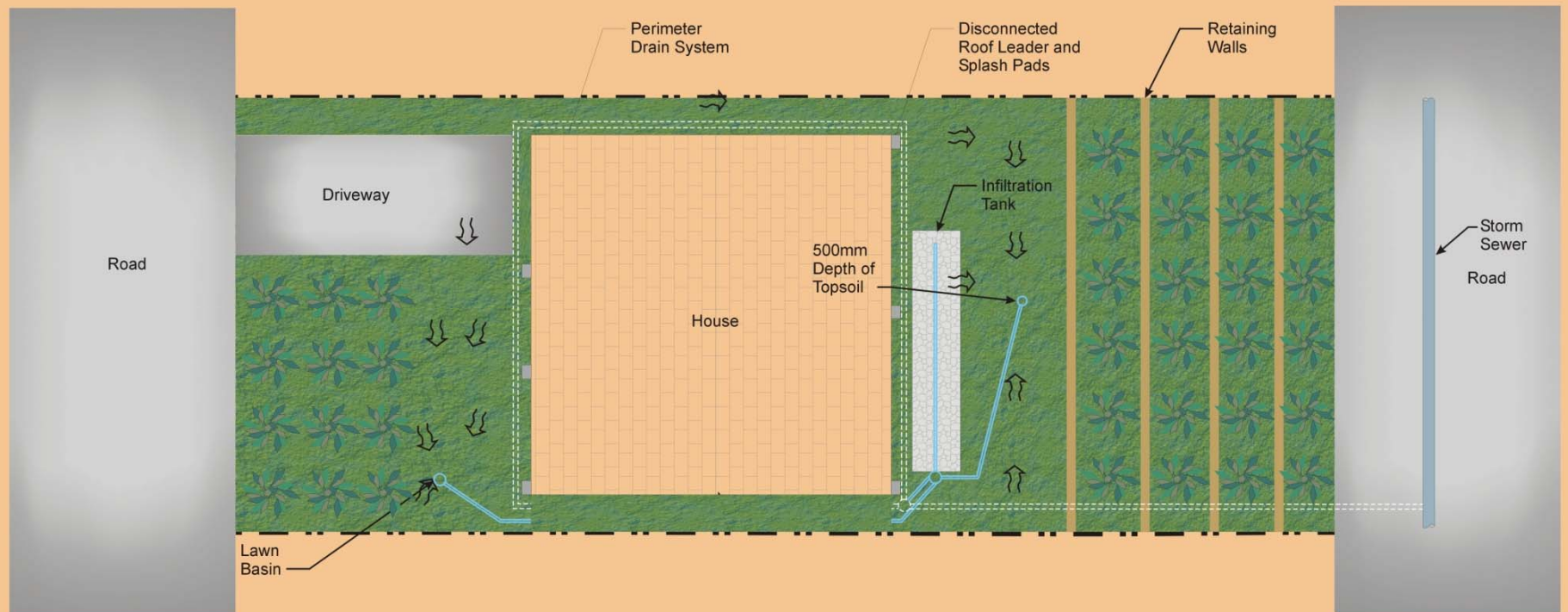


# INNOVATIVE STORMWATER MANAGEMENT TECHNIQUES FOR STEEP SLOPES















**STEEP GRADES  
IMPERMEABLE AREAS**

**FLOWS**

**VOLUMES**

**FREQUENCY**

**FLOODING**

**HYDROGRAPH**

**SOIL STABILITY**

**EROSION**

**WATER QUALITY**

**CONSEQUENCE OF FAILURE**







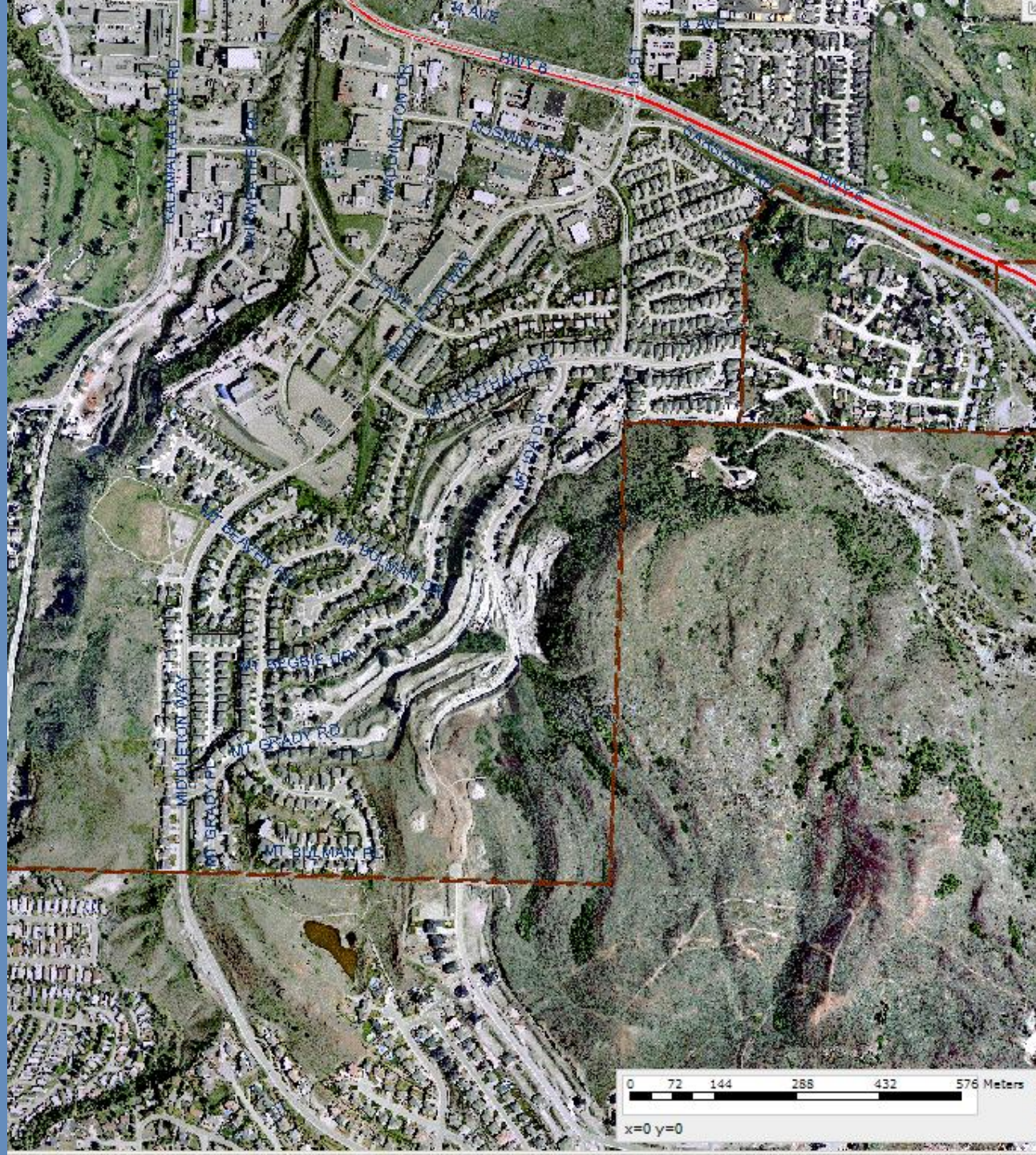








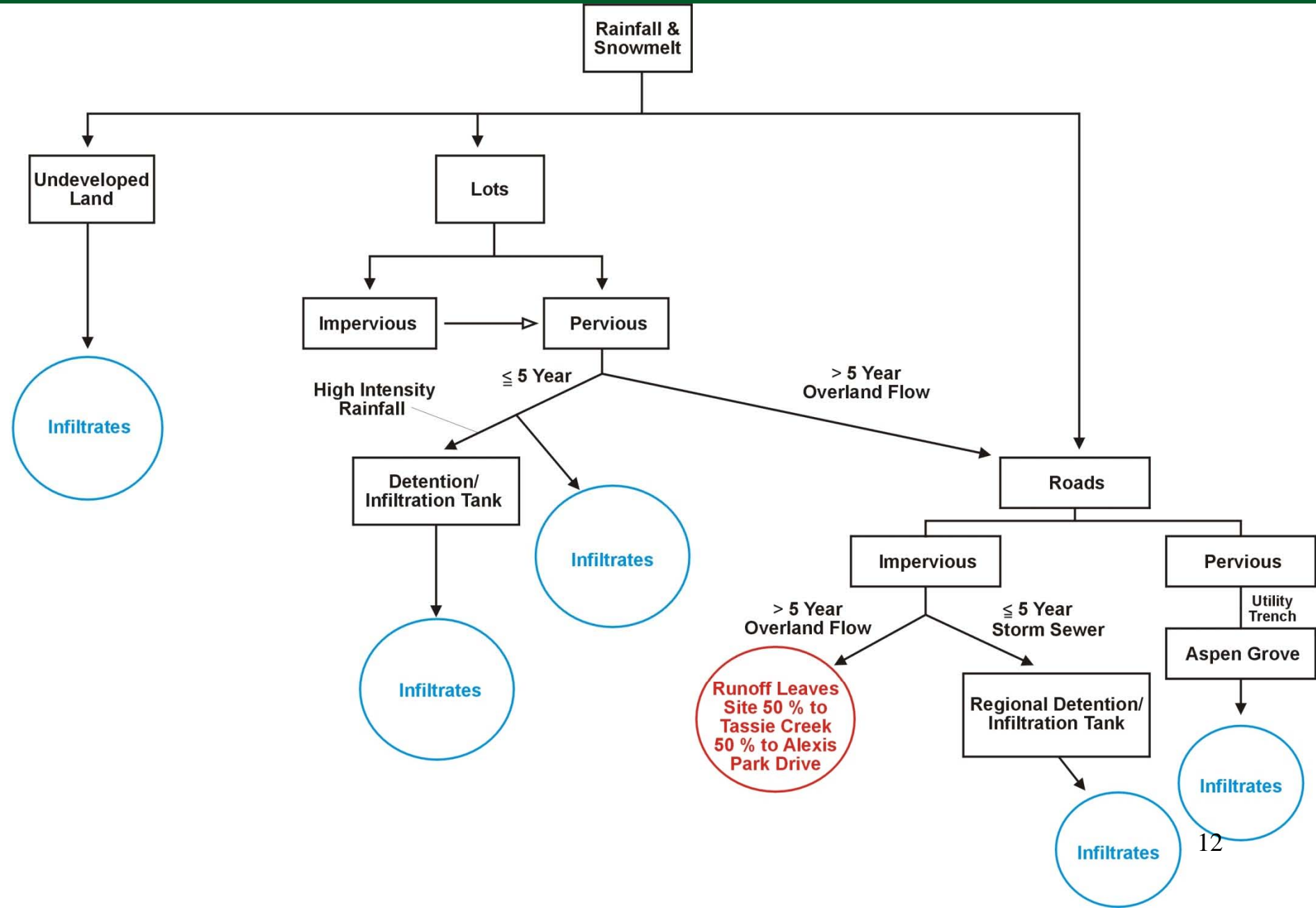








# STORMWATER MANAGEMENT STRATEGY

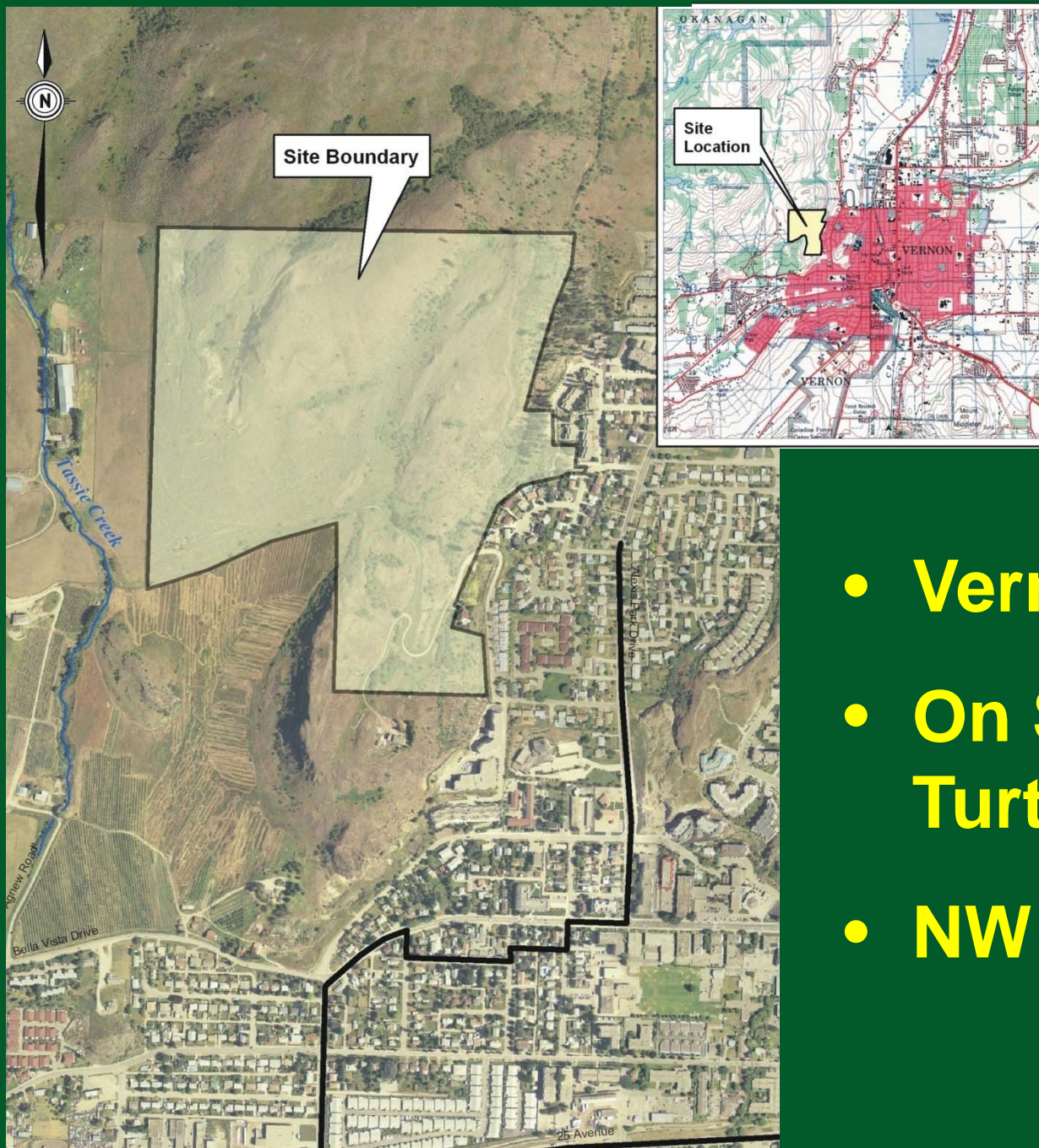




# TEAM

- **Developer: Wesbild Holdings**
- **Civil and Stormwater:  
Kerr Wood Leidal Associates**
- **Landscaping: Durante Kreuk**
- **Geotechnical: Fletcher Paine  
Associates**

# SITE LOCATION



- **Vernon, B.C.**
- **On Slopes of Turtle Mountain**
- **NW of Downtown**



# SITE DESCRIPTION

- **North Okanagan Grasslands**
- **Sage Brush**
- **Small Copses of Deciduous Trees in Damp Areas**
- **Some Bedrock Outcroppings**





# DESIGN CRITERIA - HYDROTECHNICAL



- **City of Vernon Criteria Applies**
- **Minor Drainage System: 5-year Return Period Design Event**
- **Major System: 100-year Return Period Design Event**
- **Provide On-Site or Off-Site Detention Facilities to Restrict the Post-Development Peak Runoff to the Pre-Development Grassland Condition for 5-year Return Period Flows**

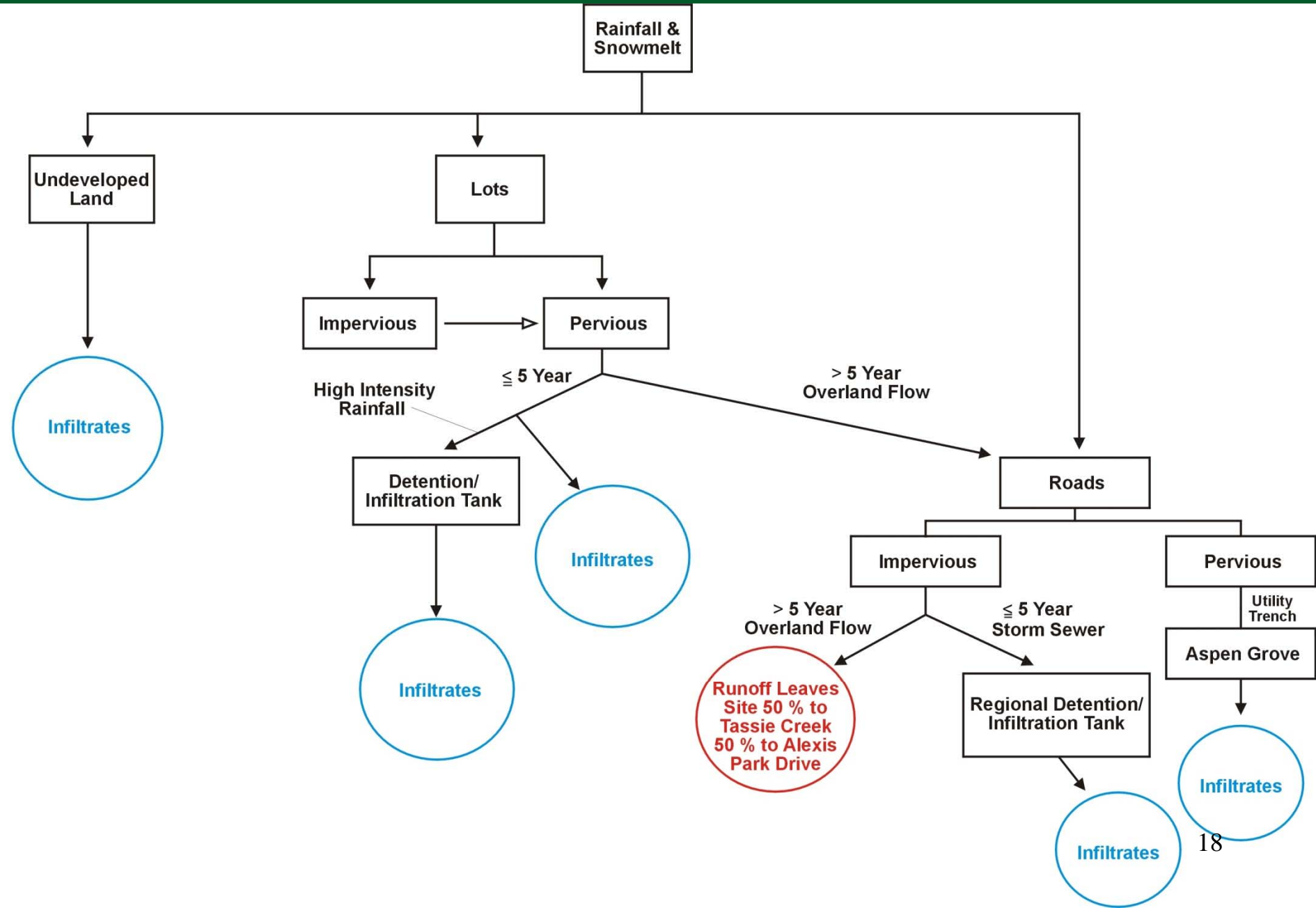


# UNIQUE CHALLENGES

- **Limit Post-Development Runoff to Pre-Development for 5-year Storm**
- **No Pre-Development Runoff = No Post-Development Runoff = Infiltration Required**
- **Steep Slopes and High Density = Difficult to Locate Detention and Infiltration Ponds**

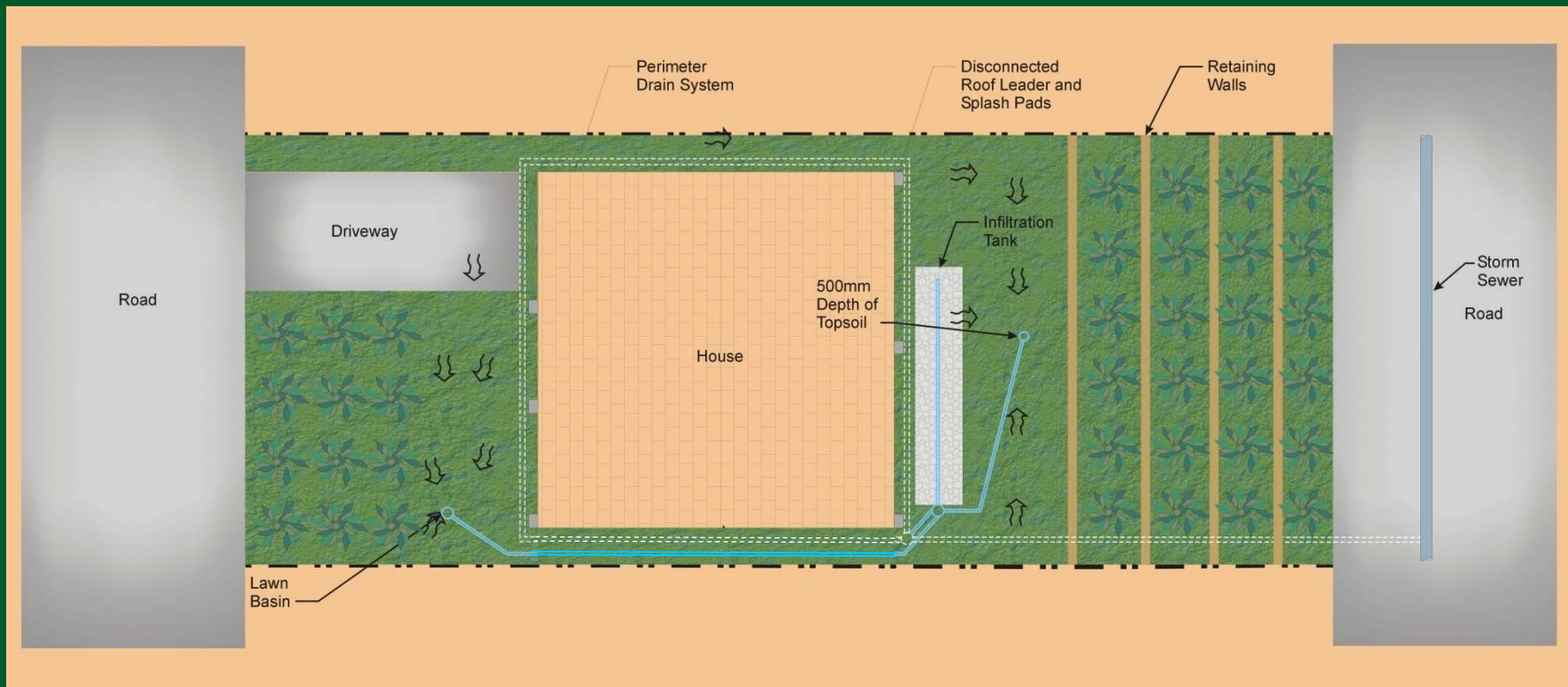


# STORMWATER MANAGEMENT STRATEGY





# LOT INFRASTRUCTURE



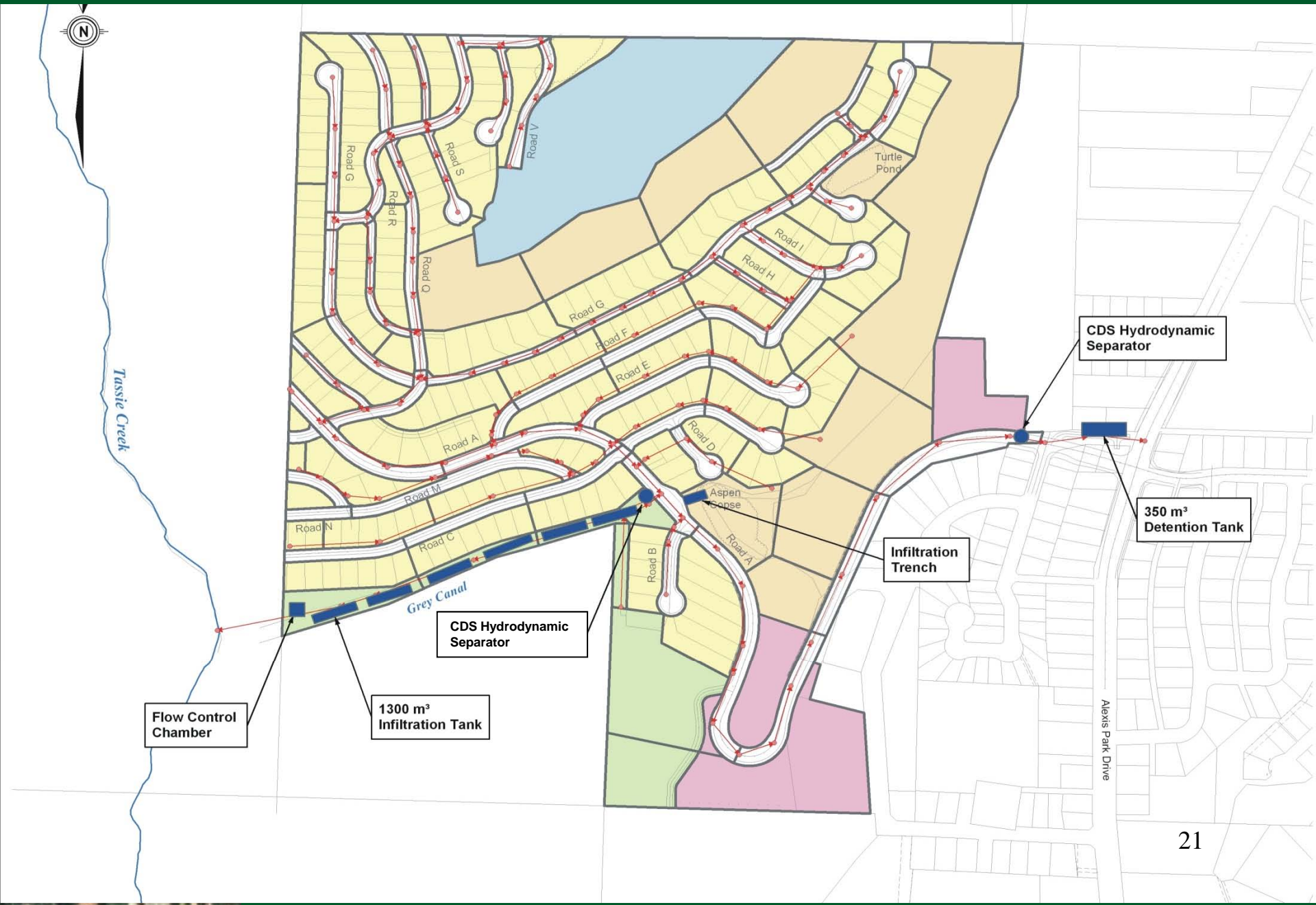
- **Goal = Capture 5-Year Event**
- **Combination of Soil and Infiltration Tank Capture**
- **500 mm Depth of Amended Topsoil with Xeriscaping to Increase Infiltration Rate**
- **Disconnected Roof Leaders**
- **Front and Backyard Lawn Basins Connected to Infiltration Tank**
- **Retaining Walls in Backyards Restrict Space Available**



# ROADS

- **Goals = Infiltrate 5-Year Event & Convey 100-year Event**
- **Slope Sidewalks to Pervious Areas- Convey to Aspen Copse by Utility Trench**
- **Curbs to Convey 100-Year Event**
- **End of Pipe Infiltration/ Detention Systems**

# END OF PIPE INFILTRATION/DETENTION

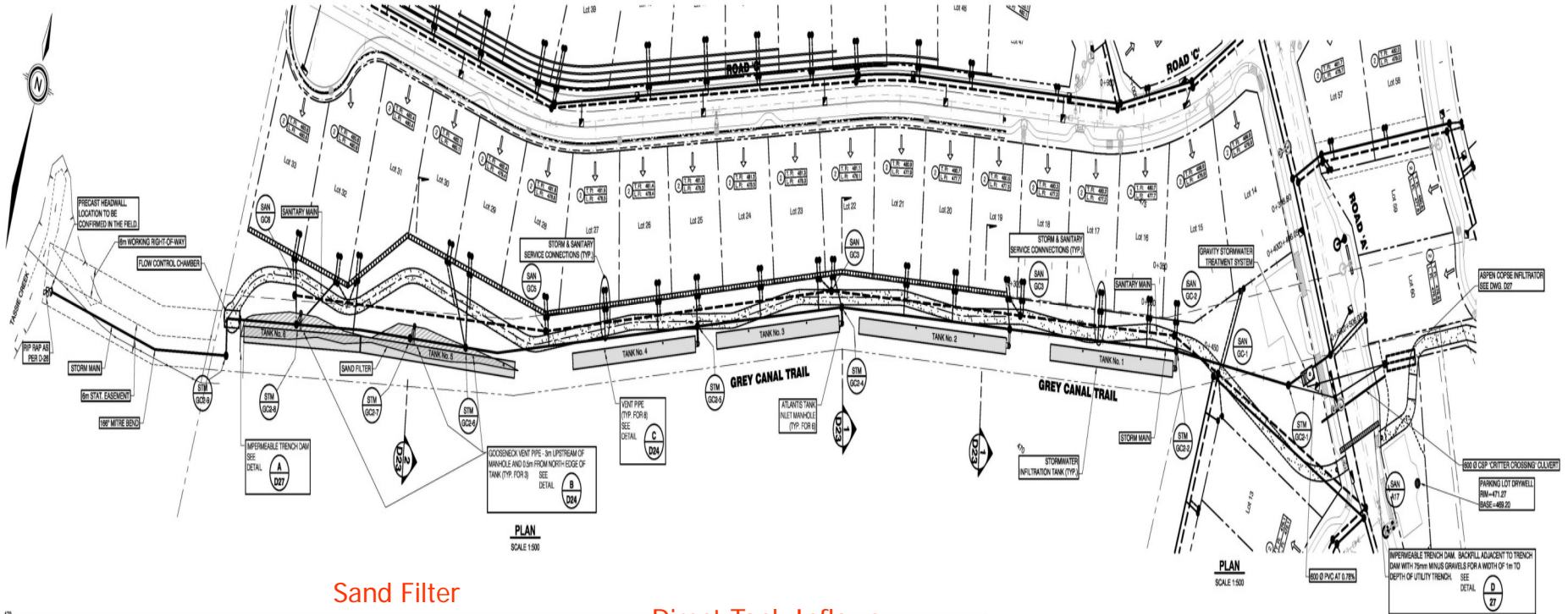




# GREY CANAL INFILTRATION SYSTEM



- **15 m wide = Not Enough Room for Pond and Trail = Infiltrate Underground**
- **Area Constraints Prevent Use of Drain Rock Filled Tanks (Void Ratio)**
- **Solution = Atlantis Tanks**
- **Pre-treatment Provided Prior to Infiltration to Maintain Infiltration**



Sand Filter  
Treatment

Direct Tank Inflows

Gravity  
Treatment

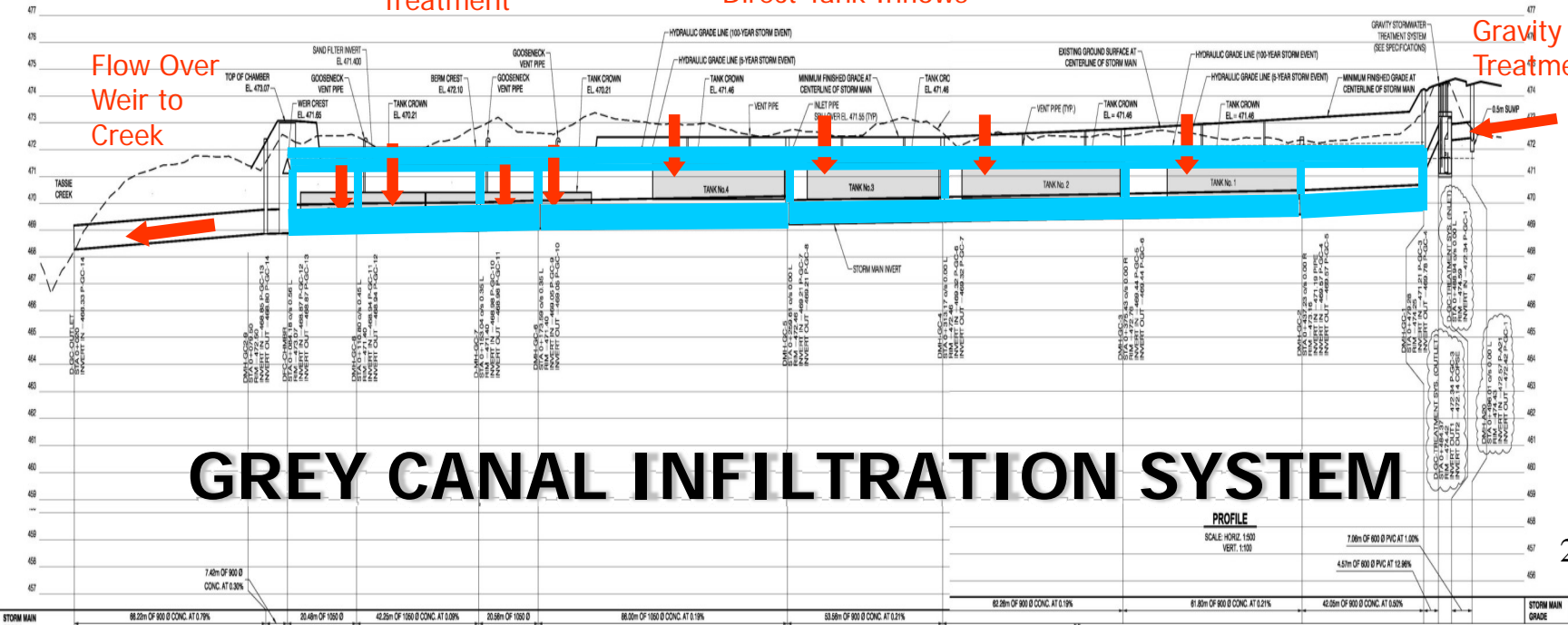
Flow Over  
Weir to  
Creek

# GREY CANAL INFILTRATION SYSTEM

**PROFILE**

SCALE HORIZ. 1:500

VERT. 1:100







Grey Canal Trail





10/09/2006



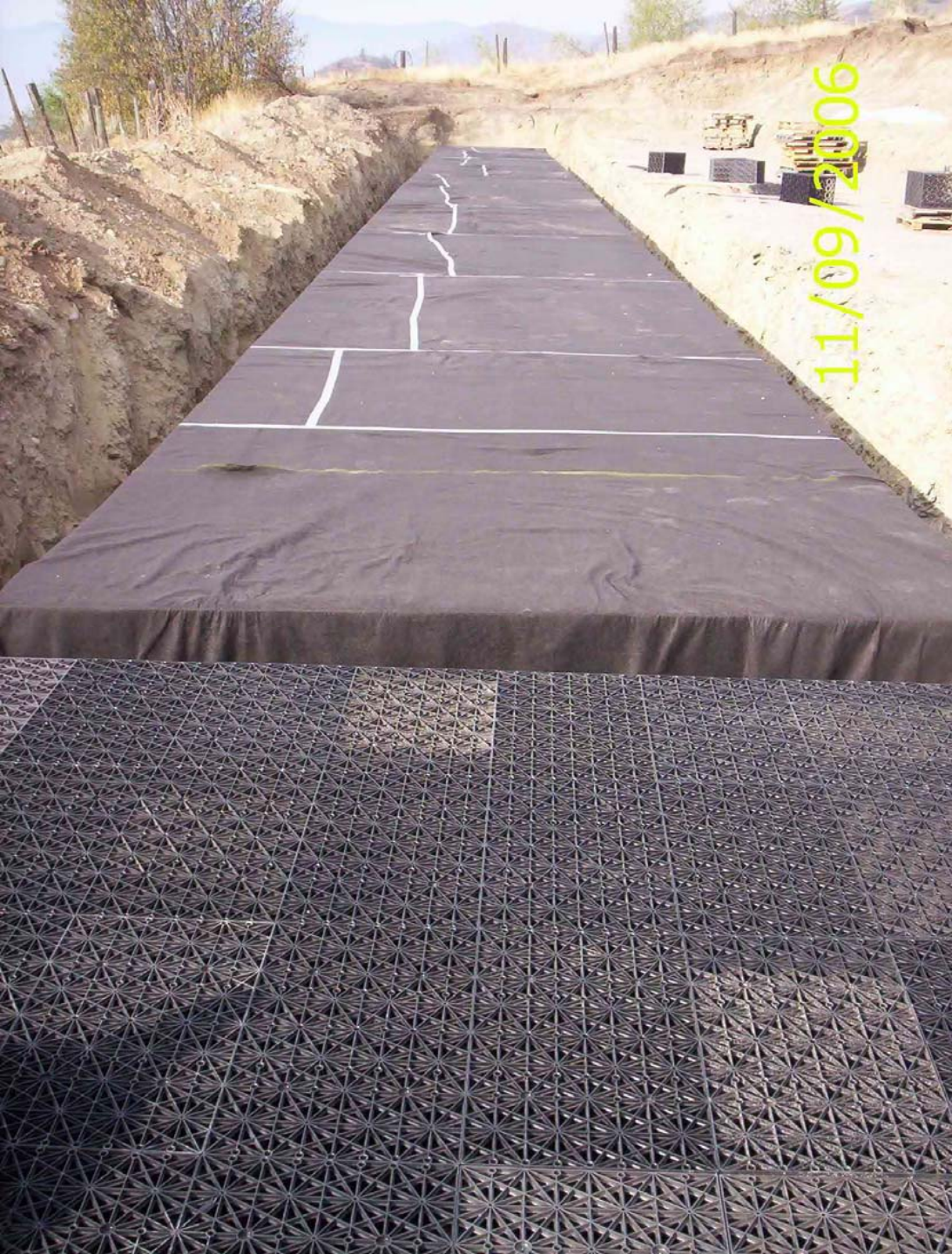
07/09/2006

# ATLANTIS TANK INSTALLATION

- Geotextile Wrapped
- Washed Sand Envelope
- Geogrid in Traffic Areas







# ATLANTIS TANK INSTALLATION

- About 4 weeks for Excavation, Installation and Backfilling of 1,300 m<sup>3</sup>





Storm Sewer

CDS Hydrodynamic  
Separator



# STORM SEWER INSTALLATION



Infiltration Tanks





Storm Sewer

Sand Filter

Flow Control Chamber





27/03/2007



# COSTS



- **On-lot Works = Projected at About \$5,000 Per Lot**
- **Little Cost Savings on Storm Sewers**
- **Grey Canal Works = \$580/m<sup>3</sup> (\$950 k)**
- **Traditional Pond = \$100/m<sup>3</sup> Including Inlet and Outlet Works**
- **Higher Costs Due to Low Pre-Development Runoff, Need for Infiltration and Site Constraints at Grey Canal**

























# QUESTIONS?

A photograph of a concrete wall with the phrase "SAVE WATER. SHOWER TOGETHER." written in white chalk. The text is arranged in four lines: "SAVE", "WATER.", "SHOWER", and "TOGETHER". The wall is a light brown or tan color with some minor texture and small dark spots. The entire image is framed by a thick black border.

SAVE  
WATER.  
SHOWER  
TOGETHER