

# Kittson Parkway / Watershed Park Parking Lot

**Date Constructed:** Summer 2005

**Site Location / Description:** Kittson Parkway, North Delta, British Columbia.  
Permeable parking lot adjacent to Watershed Park; entrance off Kittson Parkway.

**Project Description:**

- Civil Works: Permeable paver parking lot
- Stormwater: Stormwater infiltrates beneath parking lot

**Operational Issues:**

- Pervious pavers will require periodic cleaning to remove sediment buildup between pavers, this site has a high rate of leaf litter from the adjacent forest

**Project Outcome:**

- Pavers are aesthetically pleasing and give a visual impression of being more sustainable than an asphalt surface





Completed project



Overflow drainage



SF-Rima 200mm x 200mm x 80mm permeable pavers

# Holly Park Parking Lot and Rain Garden

**Date Constructed:** Fall 2005

**Site Location / Description:** 62 Street, Ladner, British Columbia. Permeable parking lot and rain garden constructed in conjunction with new synthetic turf field.

## Project Description:

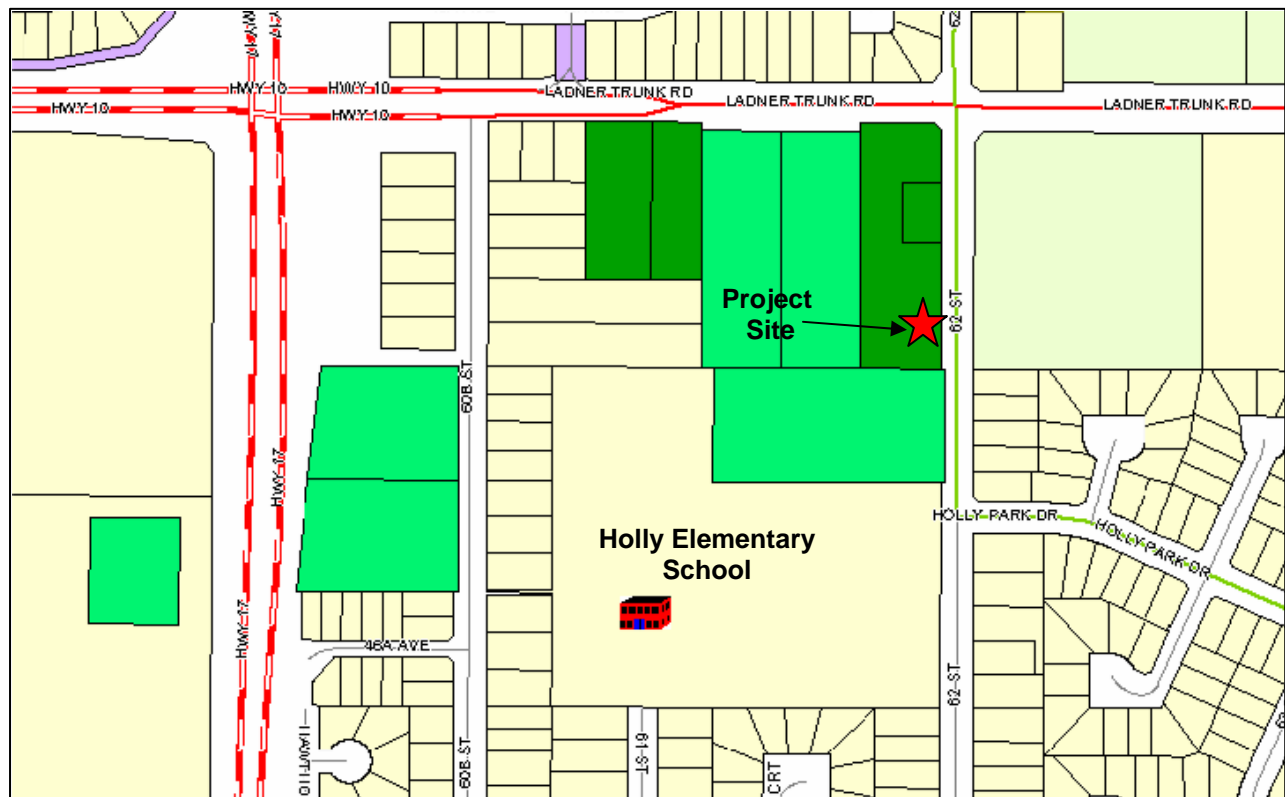
- **Civil Works:** Permeable asphalt parking lot
- **Stormwater:** Stormwater infiltrates beneath parking lot; when parking lot becomes saturated, water goes through overflow drain into rain garden (overflow was necessary because Ladner has a high water table)
- **Plants:** Rain garden planted with native, water-tolerant plants (hawthorn)

## Operational Issues:

- **Maintenance:** Permeable asphalt should be vacuumed regularly to maintain porous space; we do not have vacuum equipment so we are washing the asphalt with high-pressure water (this is another recommended cleaning technique)

## Project Outcome:

- Permeable asphalt is working; paved surface remains free of water during heavy rainfall events
- Drainage system works well; rain garden has standing water throughout the wet season





Parking lot under construction



Permeable asphalt parking lot

## 55B Street BMP

**Date Constructed:** Fall 2005

**Site Location / Description:** 55B Street near 14B Avenue, Tsawwassen, British Columbia. BMP located between a parking lot and a road.

### Project Description:

- **Drainage Problem:** Gravel area between parking lot and street is often flooded
- **Drainage Solution:** Stormwater runoff flows from road into curbed planter area via curb cuts
- **Plants:** Small trees are planted at intervals between curb cuts, allowing water to infiltrate into the ground before reaching the overflow drain

### Operational Issues:

- none

### Project Outcome:

- Not constructed as designed due to miscommunication; the idea was for the water to run into the planter and infiltrate; not much water enters the planter as constructed because the soil in the planter was accidentally mounded for planting; asphalt diverters were installed in an attempt to mitigate this problem





BMP area prior to construction



After construction (January 2006)



After planting (July 2006)



Asphalt diverter for directing drainage into planter

## 86 Avenue – North Delta Community Park

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**Date Constructed:** April 2006

**Site Location / Description:** 86 Avenue interface with North Delta Community Park, North Delta, British Columbia. BMP is a vegetated infiltration swale above a filled ditch.

### **Project Description:**

- **Civil Works:** Sidewalk adjacent to park; asphalt paving improvements on 86 Ave
- **Stormwater:**
  - Stormwater runoff flows from road into planted infiltration swale (no curb)
  - Stormwater pipe diverted into infiltration gallery beneath swale; empty plastic boxes used to store and infiltrate water on site; excess water flows back into storm system
- **Plants:** Bottom of swale contains water-tolerant plants; swale sides contain drought-tolerant plants; strip of grass along 86 Avenue helps filter contaminants from vehicles before entering planted area

### **Operational Issues:**

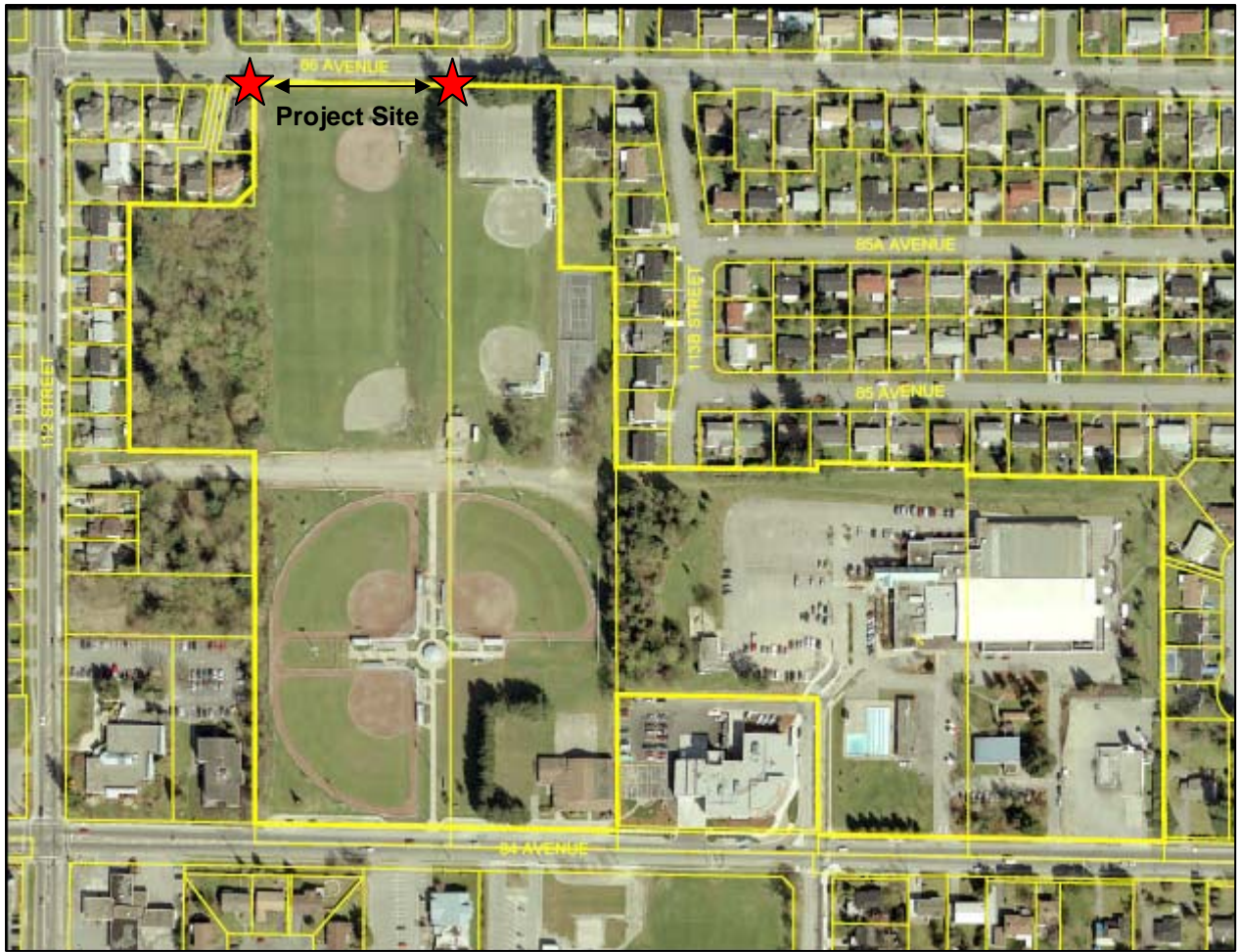
- **Maintenance:** A grass strip must be mowed and the planted area weeded

### **Project Outcome:**

- Swale works well; the plants were so popular that many 'disappeared'







Pre-construction site conditions (after ditch infill)



Construction of underground infiltration gallery



After construction and planting (April 2006) – barriers were later removed

# Lyon Rd at Cougar Canyon Elementary School

**Date Constructed:** August 2005

**Site Location / Description:** Lyon Road, North Delta, British Columbia. BMP located at an elementary school crosswalk; near Cougar Canyon environmental reserve.

## Project Description:

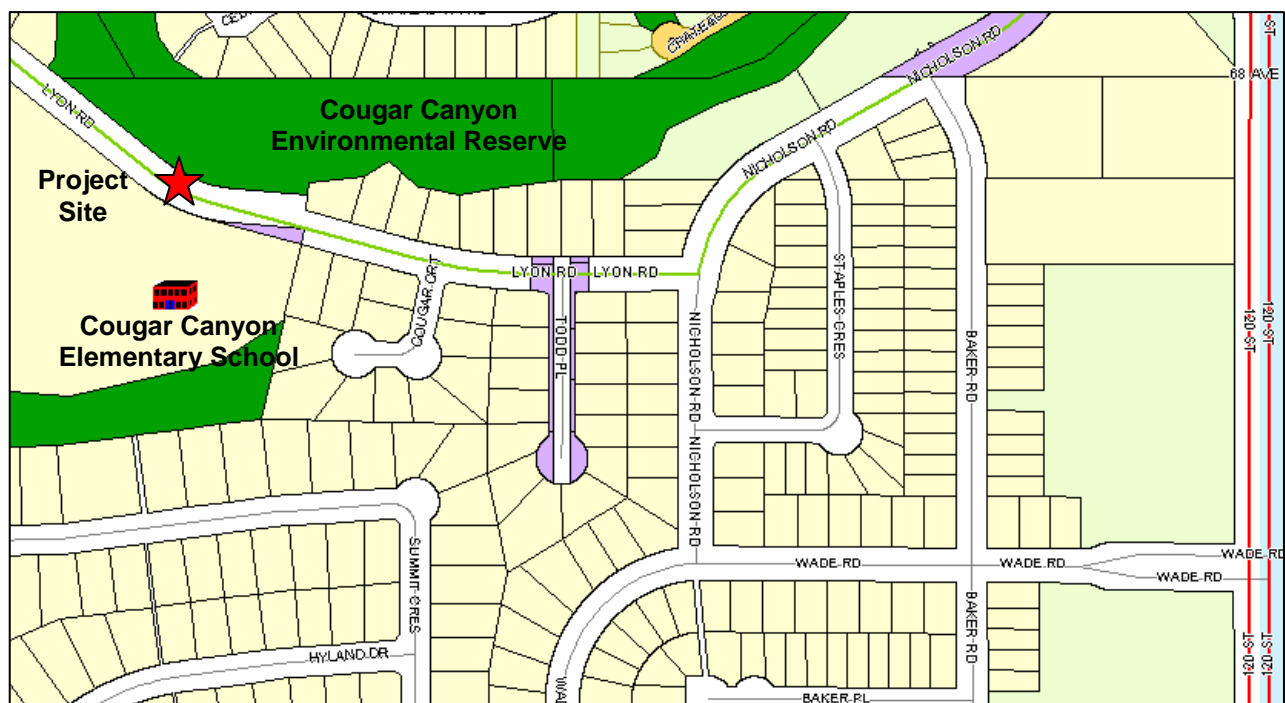
- **Civil Works:** Curb extensions at school crosswalk contain planting areas
- **Stormwater:**
  - Stormwater from road directed into planting areas via cuts in curb
  - Planting areas formed into swales to infiltrate water
  - Drain rock under planting areas for infiltration
  - Overflow at low end of swales leads to existing storm system
  - Perforated pipe leads from catch basin back into drain rock under garden, maximizing the amount of water infiltrated into ground
- **Plants:** Bottom of swale contains water-tolerant plants; swale sides contain drought-tolerant and erosion-controlling plants

## Operational Issues:

- **Maintenance:** Some of the plants are perennials, requiring a higher level of maintenance than shrubs.
- **Vandalism:** Location next to sidewalk creates easy access for bicycles; plants were damaged by bicycle tires; this damage decreased once plants became established and filled out the swale

## Project Outcome:

- Project was successful in diverting water from street into BMP; plants are healthy





Crosswalk before construction (spring 2005)



North side during construction (summer 2005)



South side during construction



North side after planting; overflow grate still to be installed on pipe in foreground



South side after planting (summer 2005)



North side during heavy rainfall event (September 2005); runoff entering from the curb cut was absorbed by the drain rock within 50cm of entering the swale

# Sunwood Drive & Wade Road

**Date Constructed:** August 2005

**Site Location / Description:** Intersection of Sunwood Drive and Wade Road, North Delta, British Columbia. Residential area. BMP located in curb extension.

## Project Description:

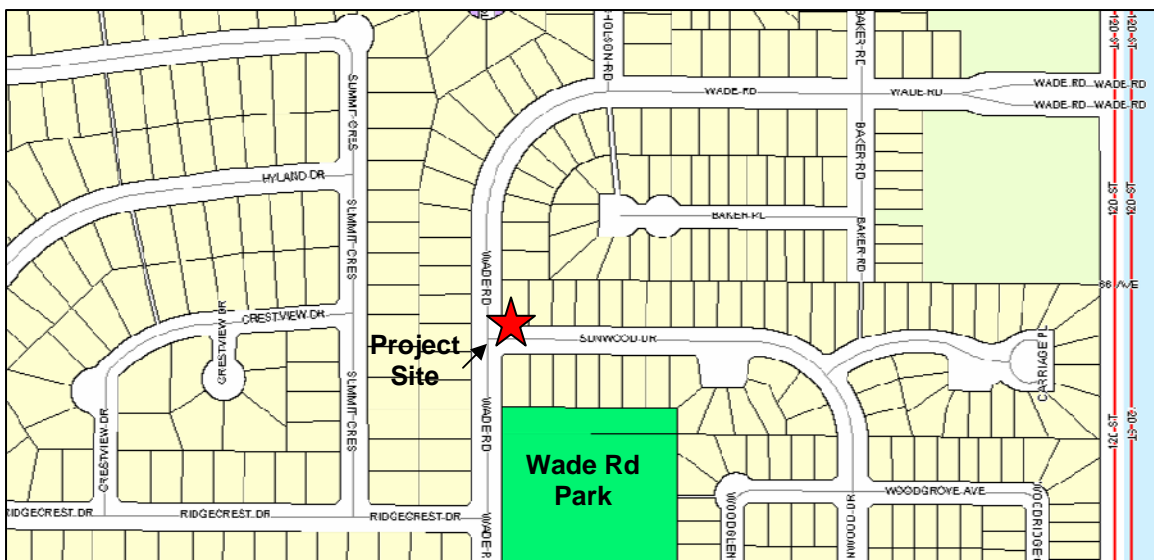
- Civil Works: Curb extension at intersection for traffic calming
- Stormwater:
  - Stormwater from road directed into planting area via cuts in curb
  - Planting area formed into swale to infiltrate water
  - Drain rock under swale for infiltration
  - Overflow at low end of swale leads to existing storm system
  - Perforated pipe leads from catch basin back into drain rock under garden, maximizing the amount of water infiltrated into ground
- Plants: Bottom of swale contains water-tolerant plants; swale sides contain drought-tolerant and erosion-controlling plants

## Operational Issues:

- Contractor education: Landscape contractor was not properly educated as to the BMP function of this site. Although contract drawing indicates swale, excess mulch was placed in the BMP causing water to leave instead of enter the planting area through the curb cut. This soil grading deficiency was repaired.

## Project Outcome:

- More grading work required to properly divert water from street into BMP
- Plants are very healthy; nearby resident might be watering the garden





Prior to construction



During construction



Curb cut

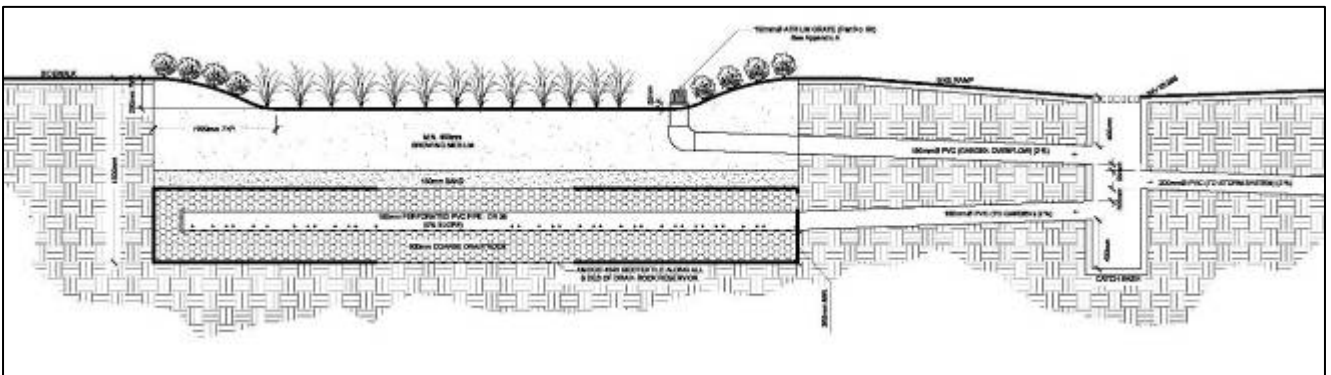


After planting; shows excess soil and incorrect grading



Extent of runoff into swale

BMP during heavy rainfall event; water not absorbed as desired due to high soil levels in planted area



Section showing construction details





July 2006



July 2006

## Delview Park Swale - South

**Date Constructed:** October 2005

**Site Location / Description:** Delview Park, North Delta, British Columbia. Community park with sports fields and passive use areas. Park is surrounded by single-family residential lots. Located near the corner of 116 Street and 92 Avenue.

### Project Description:

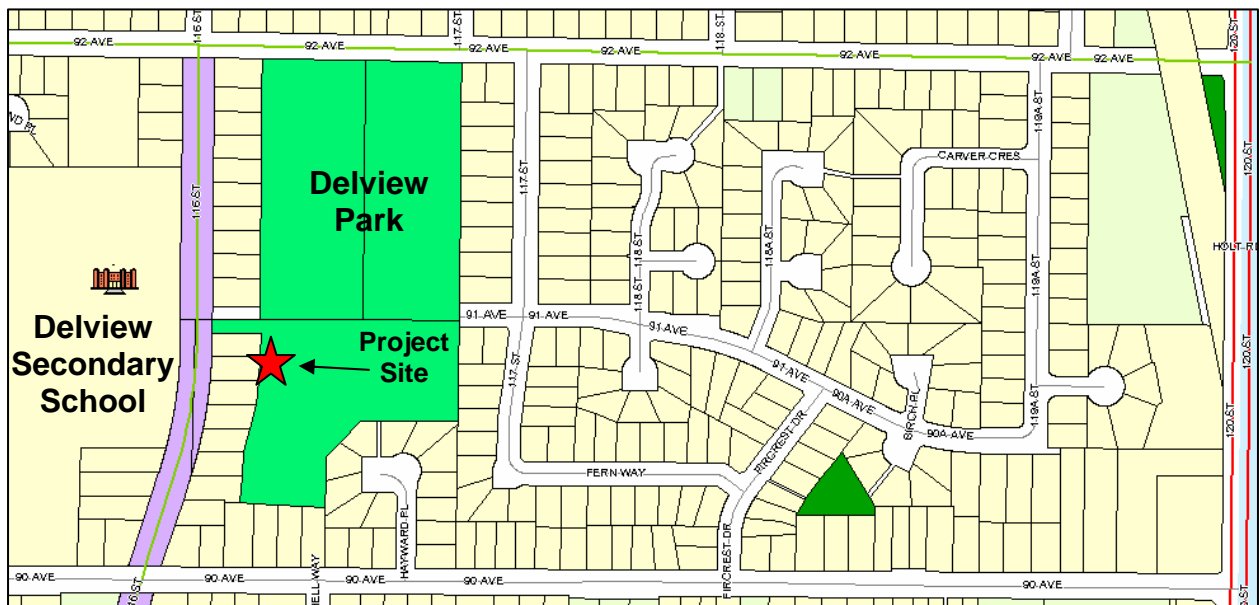
- **Drainage Problem:** Homes to the west of the park were flooded every year when runoff from the park entered the adjacent properties.
- **Solution:** Construction of a swale and rain garden along the length of three properties near the west entrance to the park; swale underlain with sand
- **Plants:** Swale planted with native plants and trees; purpose of using native plants was to reduce water in the soil by evapotranspiration; plant species selected are all tolerant of wet soil conditions

### Operational Issues:

- **Maintenance:** Volunteers are removing the major weeds, but the general idea is to allow the garden to fill with plant material in order to absorb the water
- **Flooding:** The overflow drain can become clogged with leaves in the fall; Parks Operations and local residents monitor pond to ensure flooding does not occur

### Project Outcome:

- Project was successful in reducing flooding to adjacent properties; it turned out that the winter water table was higher than our overflow drain and there was standing water until early summer; we fixed this problem by adding drain rock





Note grass damaged by annual winter flooding

Prior to construction (summer 2004)



Swale under construction;  
installation of sand and topsoil



Final grading of  
topsoil complete



Completed project (October 2005)



Community planting party;  
native, water-tolerant plants  
were used





Swale in action (October 2005)



Swales flowing into rain garden pond (October 2005)



Erosion after unusually wet winter (February 2005)



Erosion after unusually wet winter (February 2005)



Placement of rock in swale to prevent erosion and standing water (July 2006)



Swale and pond filled with native vegetation (May 2007)

# Delview Park Swale - North

**Date Constructed:** Fall 2005 – Spring 2006

**Site Location / Description:** Delview Park, North Delta, British Columbia. Community park with sports fields and passive use areas. Park is surrounded by single-family residential lots. Located near the corner of 116 Street and 92 Avenue.

## Project Description:

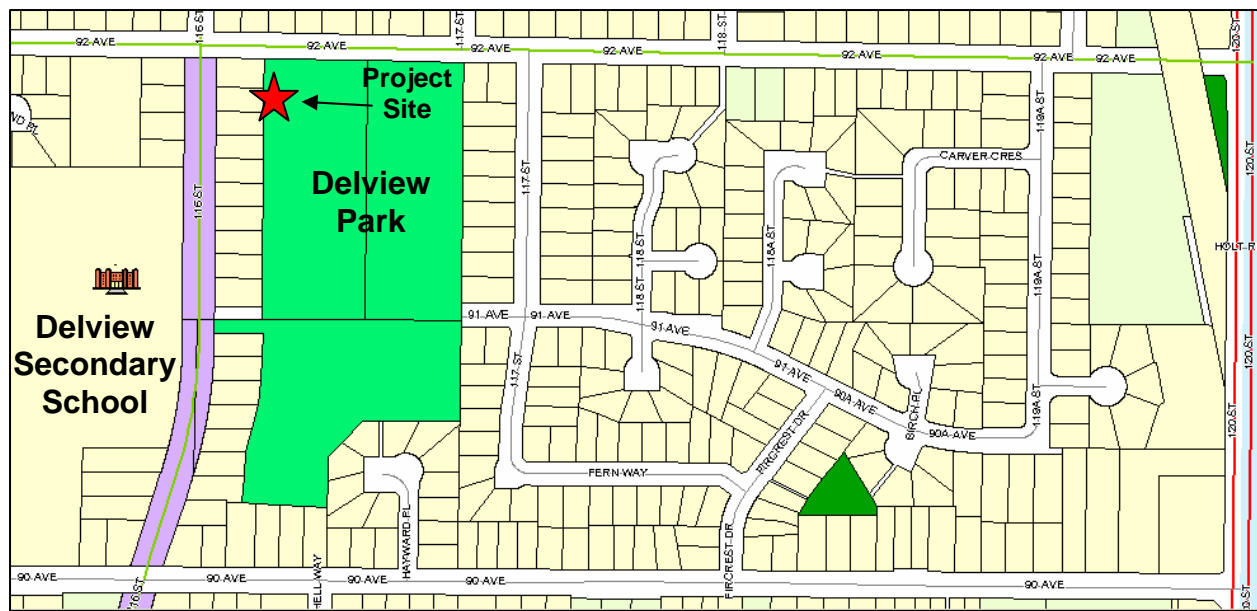
- **Drainage Problem:** Homes to the west of the park were flooded every year when runoff from the park entered the adjacent properties.
- **Solution:** Construction of a swale along the length of three properties at the northwest corner of the park; swale underlain with drain rock
- **Plants:** Swale planted with turf to reduce erosion and maintain grassed surface for sports field users

## Operational Issues:

- **Timing:** Project construction began in October; wet weather slowed construction considerably because movement of large equipment on wet turf damaged the playing fields; construction in dry weather would have been preferable

## Project Outcome:

- Project was very successful in reducing flooding to adjacent properties; the key to the success of this project was the use of drain rock







Temporary trench (summer 2005)



Installation of drain rock



Completed swale (October 2005)



Temporary trench (hidden by overgrown grass) (summer 2005)



Completed swale with berm on fence side (October 2005)



Swale after re-grading to make shallower for sports field users; planted with grass  
(April 2006)

# Evergreen Lane Parking Lot

**Date Constructed:** Summer 2005

**Site Location / Description:** Evergreen Lane & 47 Avenue, Ladner, British Columbia. Parking lot for seniors recreation centre and lawn bowling club; residential / civic area.

## Project Description:

- Civil Works: Parking lot
- Stormwater:
  - Stormwater from crowned parking lot flows into planting beds
  - Overflow drains in each planting bed connect to storm system
  - Main water-collecting beds contain 1.5 metres of topsoil to collect and infiltrate stormwater
  - Drain rock was not feasible. Ladner is below sea level, so winter groundwater levels are near surface.
- Plants: Central areas of gardens contain water-tolerant plants; swale sides contain drought-tolerant and erosion-controlling plants

## Operational Issues:

- Summer Maintenance: Some plants are perennials, which require a higher level of maintenance
- Winter Maintenance: Grade change between asphalt parking surface and concrete walkway resulted in a minor depression between the two areas; this depression will require salting on cold days to ensure pedestrian safety

## Project Outcome:

- High volume of topsoil appears to be successful in containing all runoff from the paved surfaces





Site prior to construction



Sidewalk around planting area under construction



Stamped asphalt parking lot under construction



Planting beds for stormwater collection (east side)



Planting bed for stormwater collection (west side)



Permeable pavers on low-use driveway; tree retained



Completed project after heavy rainfall event; note pooling of water between asphalt parking lot and concrete walkway, and within the planting area



Flower display (June 2006)



Flower display (August 2006)



# Cougar Canyon Elementary School – Rain Garden

**Date Constructed:** August 2006

**Site Location / Description:** 11664 Lyon Rd, North Delta, British Columbia. School parking lot drains into rain garden. Adjacent to Cougar Canyon environmental reserve.

## Project Description:

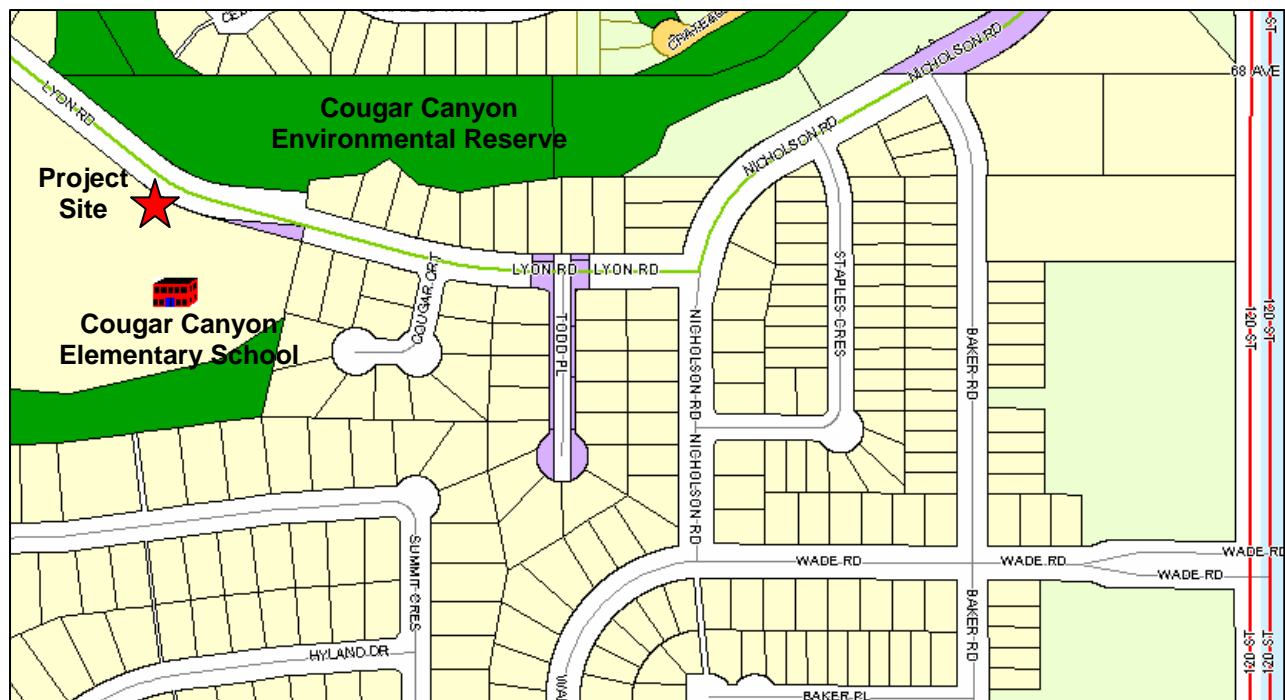
- **Civil Works:** Removal of two catch basins in parking lot; water redirected toward rain garden; garden overflows into storm system.
- **Plants:** Garden contains drought-tolerant plants; many plants are native; design of garden was meant to mimic alpine, forest, and coastal plant communities
- **Signage:** A sign was installed to explain the reason for the rain garden to students and the public

## Operational Issues:

- **Maintenance:** Plants will be maintained by volunteers and the school board

## Project Outcome:

- Construction was a success; no problems.
- Plants were installed by Streamkeepers and every child attending Cougar Canyon elementary school during the 2006/2007 school year





Prior to construction (March 2006)



Swale excavation (August 2006)



Swale completed (August 2006)



After planting by volunteers and entire student population of Cougar Canyon Elementary (November 2006)



New signage with rain garden in background (April 2007)



Rain garden (June 2007)

# Lyon Rd and Lawrie Crescent BMP

**Date Constructed:** August 2006

**Site Location / Description:** Intersection of Lyon Rd and Lawrie Crescent, North Delta, British Columbia. Roadside swale drains into rain gardens.

**Project Description:**

- Civil Works: Sidewalk installation and repaving; road drains to swale
- Plants: Drought-tolerant, low maintenance plants were used in this design

**Operational Issues:**

- None

**Project Outcome:**

- New sidewalk cleaned up streetscape; rain gardens functional





Pre-construction condition (spring 2006)



After construction (October 2006). Grass swale drains to rain garden. Overflow drain is behind the stop sign. Existing garden behind construction area was retained.

# 108 Street Parking Improvements

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**Date Constructed:** Fall 2006

**Site Location / Description:** 108 St at Mackie Park, North Delta, British Columbia.  
New asphalt parking area drains into rain gardens

**Project Description:**

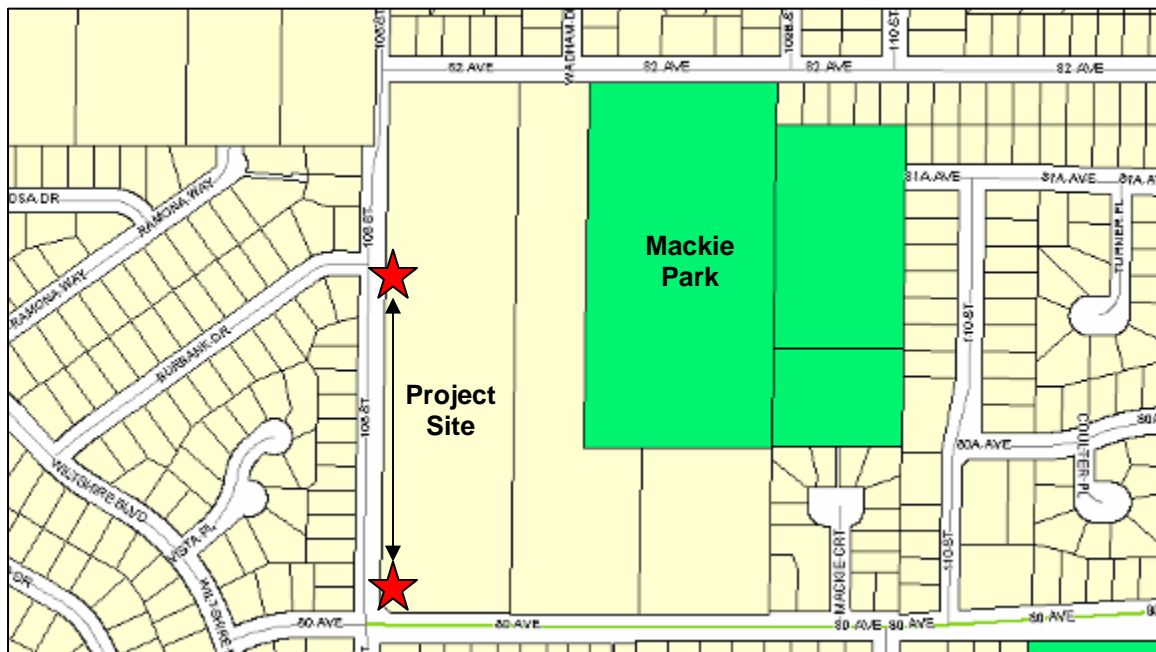
- Civil Works: Construction of asphalt 90° parking
- Plants: Drought-tolerant, native plants were used in this design

**Operational Issues:**

- None

**Project Outcome:**

- Some adjustments to grading and gravel was required in gardens, but otherwise the gardens function properly to infiltrate water from parking areas





Before construction



After construction (January 2007). Rain gardens collect and infiltrate water from paved parking areas.



# 120 Street Sidewalk Project

**Date Constructed:** June 2007

**Site Location / Description:** 120 St south of Hwy 10, North Delta, British Columbia. Runoff drains into roadside swales.

## Project Description:

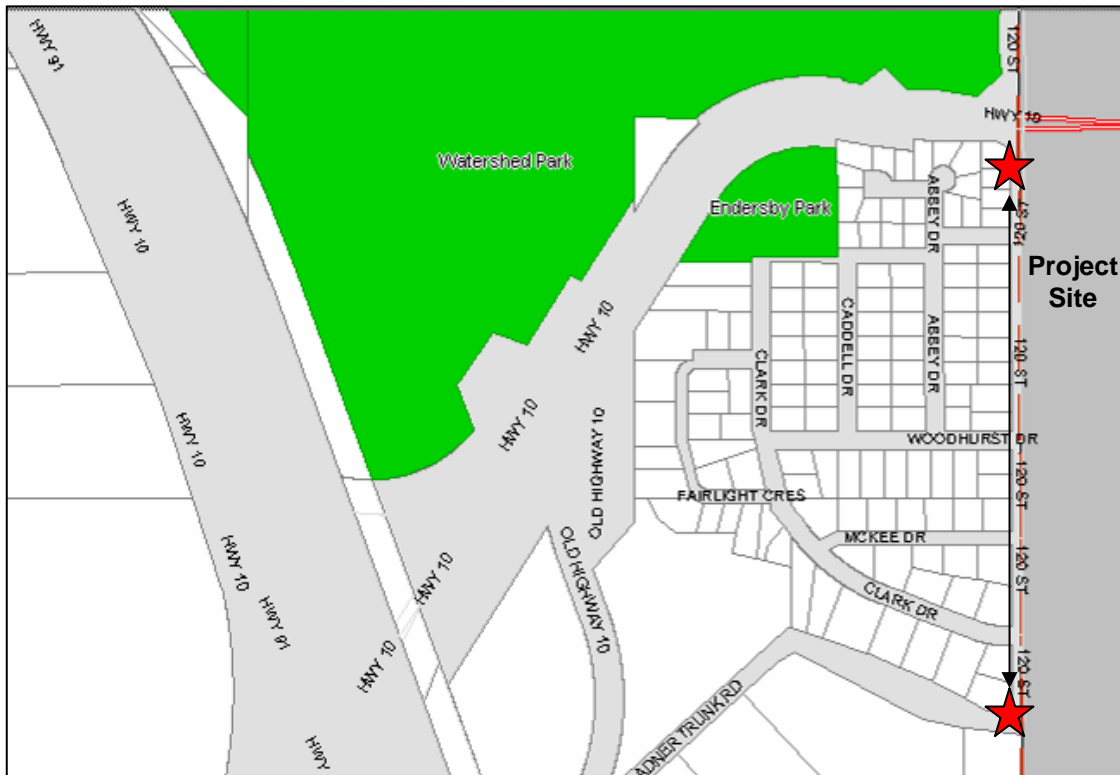
- Civil Works: Road repaving; at-grade sidewalk construction; some ditch infill on Surrey's side of the road, plus rain gardens
- Stormwater: No curb and gutter; runoff drains into roadside swales; most swale sections are turf; swales expand into larger rain gardens at street intersections
- Plants: Drought-tolerant, mostly native plants were used in this design

## Operational Issues:

- None

## Project Outcome:

- Drainage and rain gardens function as designed
- Residents have embraced the rain gardens as their own and are providing extra maintenance (watering and weeding); some residents have added their own plants and landscaping to the road-side swales





At-grade asphalt sidewalk; typical grass swale in background and resident's landscaping additions in foreground

# Fairlight Ditch Daylighting

**Date Constructed:** Summer 2006

**Site Location / Description:** 5612 Fairlight Crescent, North Delta, British Columbia. Runoff drains into daylighted, landscaped ditch.

## Project Description:

- Civil Works: A 10-metre section of the 300mm concrete storm pipe on Fairlight Crescent was removed to construct a new section of ditch
- Stormwater: The purpose of daylighting the ditch was to allow stormwater in the pipe to infiltrate into the ground; bottom of the ditch contains drain rock to increase rate of infiltration
- Plants: Resident at this address planted and maintains the garden

## Operational Issues:

- None

## Project Outcome:

- Construction went as designed
- Resident made “fine-tuning” modifications to make ditch appear more like a natural stream
- Ditch appears to be working; water was observed during a heavy rain storm to be flowing into the ditch at a high volume and flowing out of the ditch at a much lower volume





Site prior to construction



During construction (June 2006); installing river rock over wrapped drain rock



Construction complete (June 2006); temporary mesh installed on road side of ditch to minimize erosion until plants are installed



After resident added driftwood and boulders (July 2006)



During heavy rainfall event (November 2006)



During heavy rainfall event (November 2006)



Summer garden display – plantings by resident (July 2007)



Explanatory signage for residents (July 2007)

# Knight Drive At-grade Sidewalk

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**Date Constructed:** November 2006

**Site Location / Description:** Knight Drive (64 Ave to Bond Blvd), North Delta, British Columbia. Runoff from road flows into grassed and planted swales; at-grade sidewalk.

## Project Description:

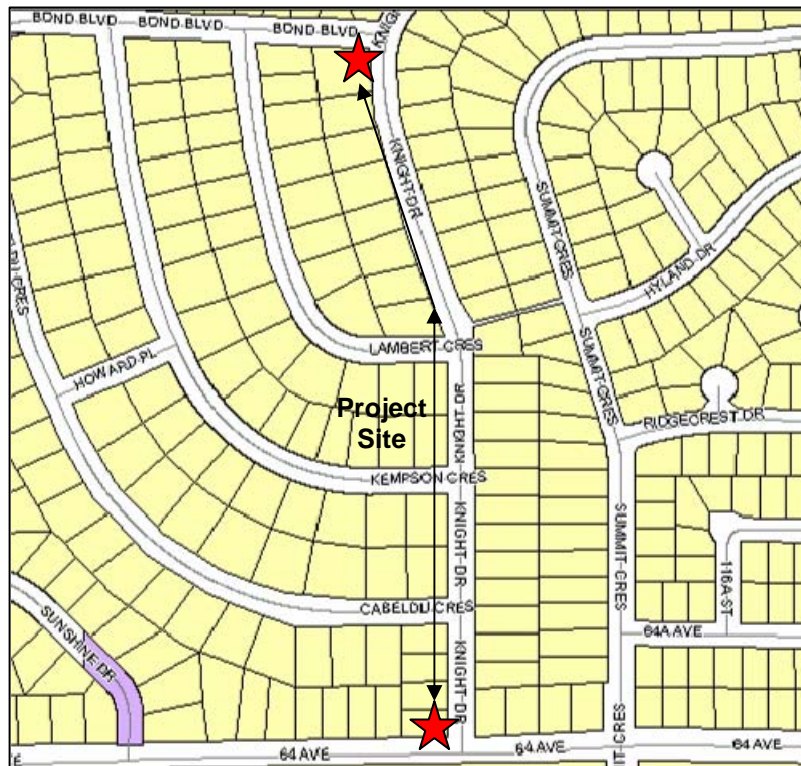
- Civil Works: At-grade sidewalk construction
- Stormwater: No curb and gutter; runoff drains into roadside swales; most swale sections are turf, and some are planted with low shrubs
- Plants: Drought-tolerant plants were used in this design

## Operational Issues:

- None

## Project Outcome:

- Construction went as designed
- Residents were opposed to an at-grade sidewalk at first, instead wanting the more finished look of curb-and-gutter; staff sent an explanatory letter to residents describing the sustainable design and purpose of the road-side swales
- Swales appear to be working







Knight Drive at-grade sidewalk under construction (November 2006)



Swale plantings (November 2007)



Low shrubs planted in narrow section between road and at-grade sidewalk discourage parking on sidewalk and separate traffic from pedestrians (November 2006)



Swale plantings (September 2007)