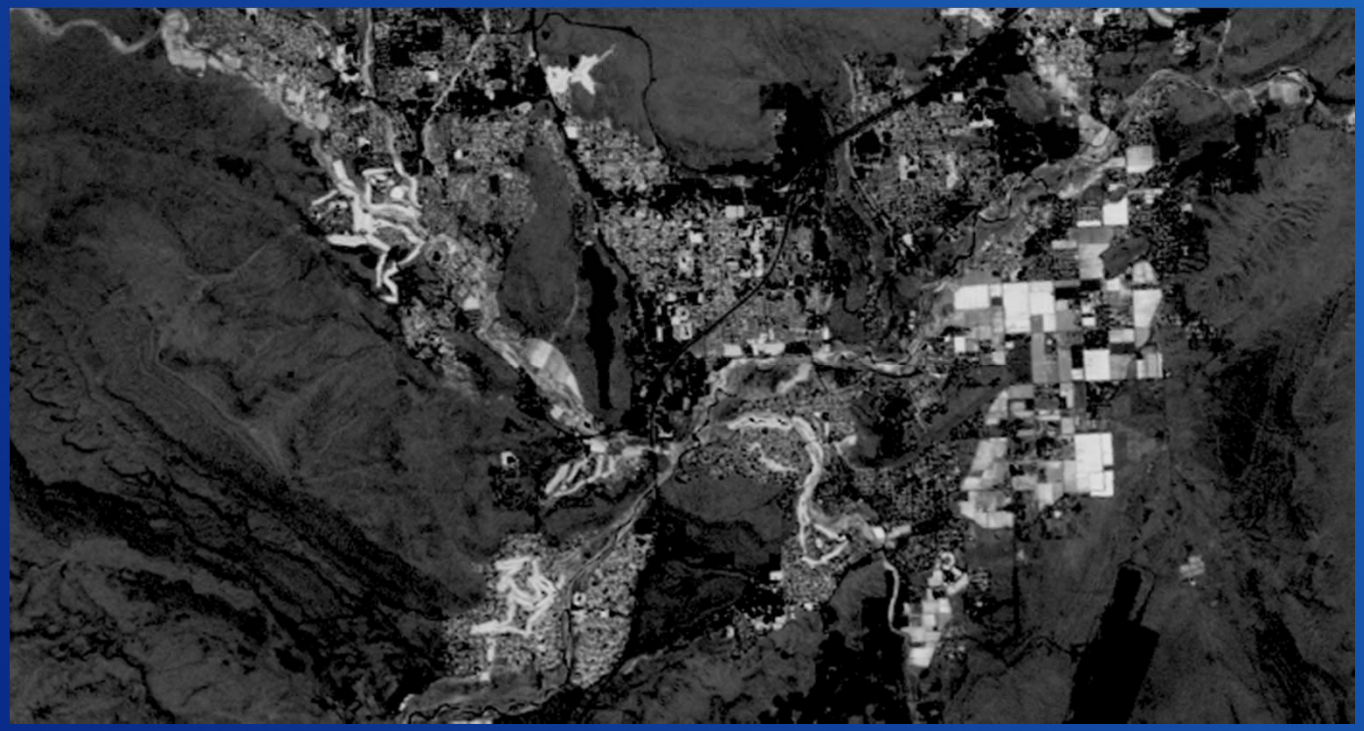
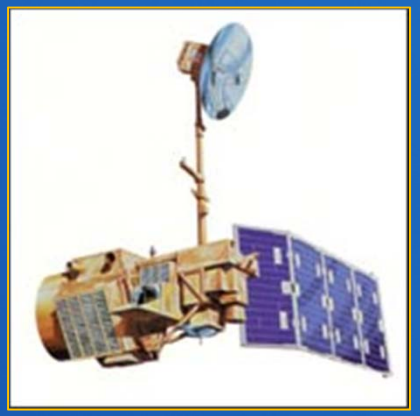
Landsat 5 and NDVI - Background



Town of St George

RECLAMATION

Landsat 5



NASA launched in 1984

Thematic Mapper (TM) instruments includes Seven spectral bands, including a thermal band:

- **Band 1 Visible (0.45 – 0.52 µm) 30 m**
- **Band 2 Visible (0.52 – 0.60 µm) 30 m**
- **Band 3 Visible (0.63 – 0.69 µm) 30 m**
- **Band 4 Near-Infrared (0.76 – 0.90 µm) 30 m**
- **Band 5 Near-Infrared (1.55 – 1.75 µm) 30 m**
- **Band 6 Thermal (10.40 – 12.50 µm) 120 m**
- **Band 7 Mid-Infrared (2.08 – 2.35 µm) 30 m**
- **Ground Sampling Interval (pixel size): 30 m reflective, 120 m thermal**

NDVI

Normalized Difference Vegetation Index (NDVI)

Band 3 Visible Red (0.63 – 0.69 µm) 30 m
Band 4 Near-Infrared (0.76 – 0.90 µm) 30 m

NDVI = (NIR 4 - VIS 3) / (NIR 4 + VIS 3)

NDVI varies between -1.0 and +1.0

RECLAMATION

NDVI

- **The pigment in plant leaves, chlorophyll, strongly absorbs visible light (from 0.4 to 0.7 µm) for use in photosynthesis.**

- **The cell structure of the leaves strongly reflects near-infrared light (from 0.7 to 1.1 µm).**

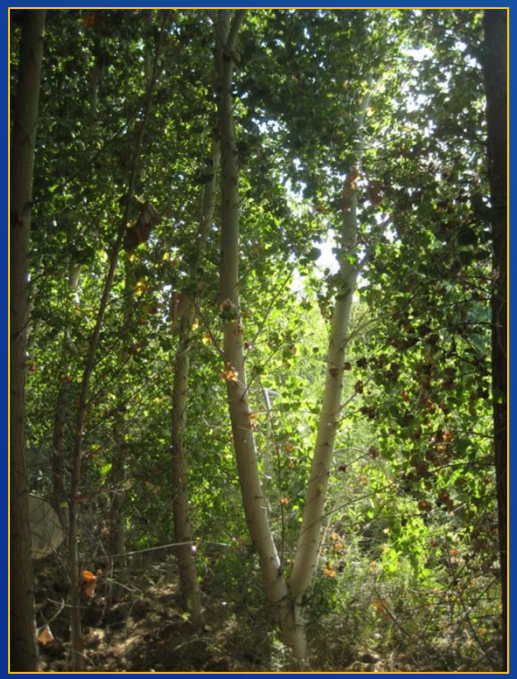
RECLAMATION

NDVI

- A dense vegetation canopy (0.3 to 0.8)
- Soils (0.1 to 0.2) Reflects near-infrared spectral somewhat larger than the red spectral
- Clear Water (very low positive or even slightly negative) low reflectance in both spectral bands

NDVI – Summary

NDVI - measurement of Photosynthetic or Greenness



RECLAMATION

GIS Process

1) Downloaded the Landsat 5 data from USGS

- Landsat 5 tracks over every 16 days
- St George on the edge of a path of the satellite
- Problem
  - Cloud Cover
  - Satellite Technical Problems

2) Process the Landsat data into NDVI

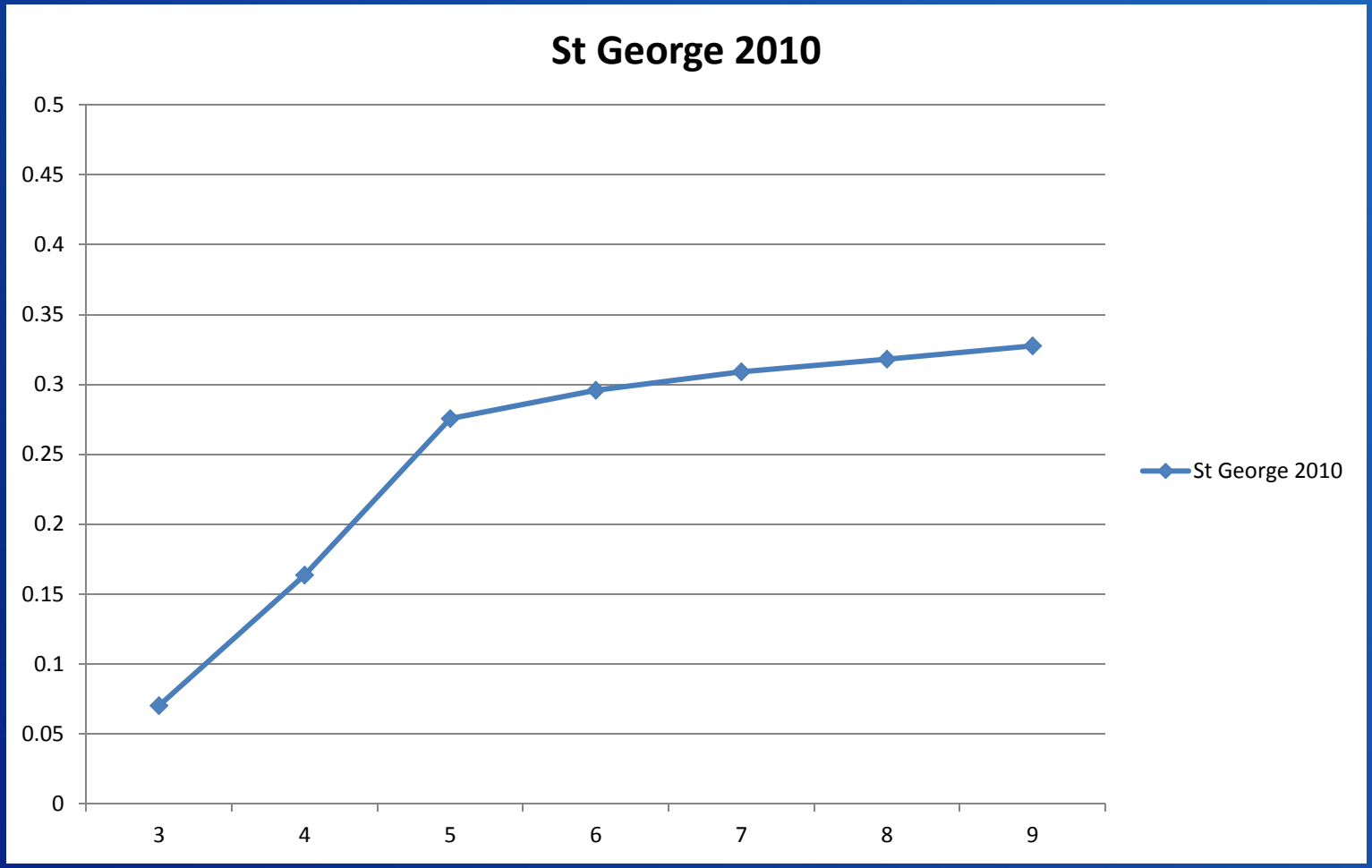
- ArcGIS

3) Calculate the NDVI at Survey Locations

- Bilinear interpolation

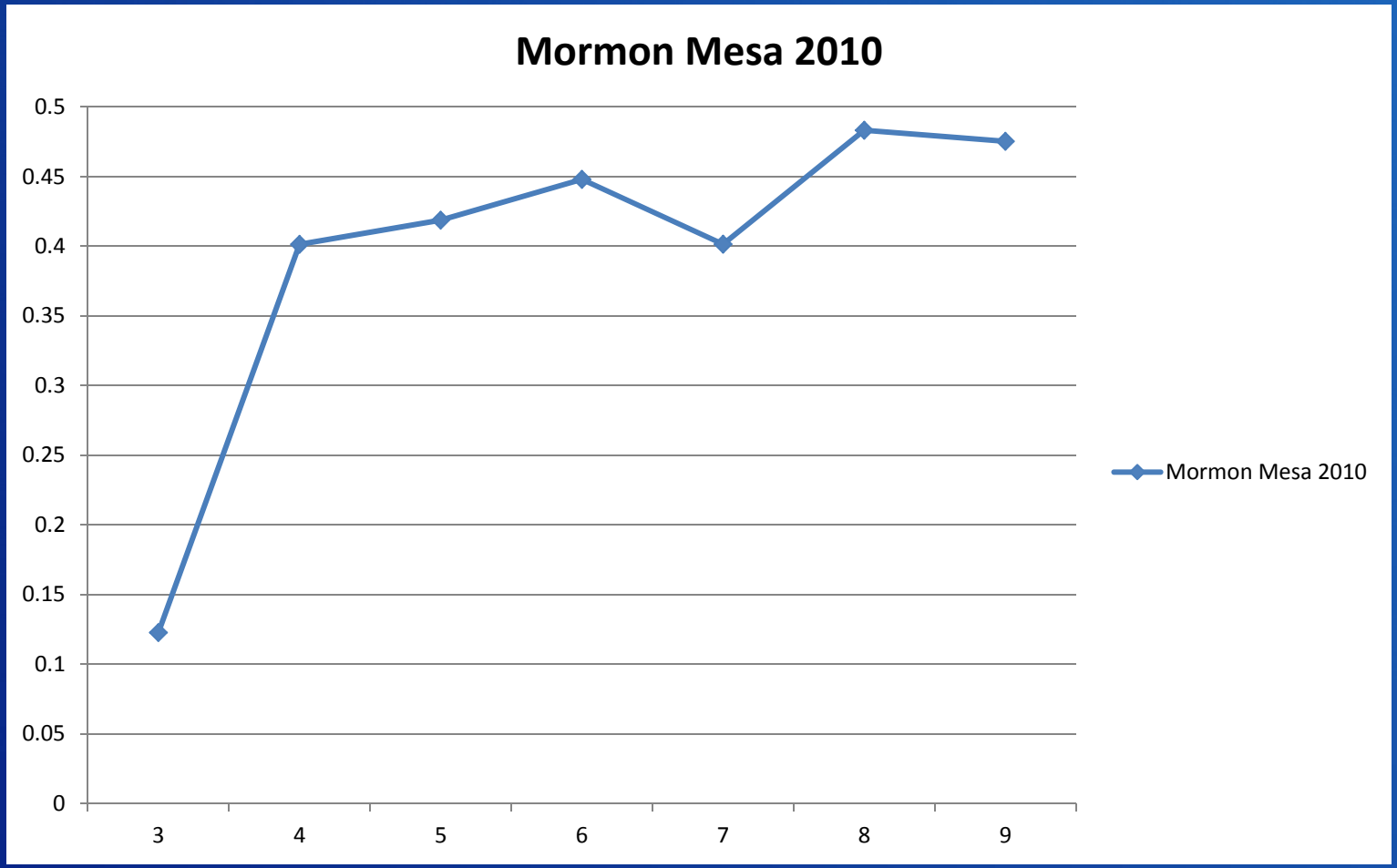
RECLAMATION

St George – Average NDVI 2010



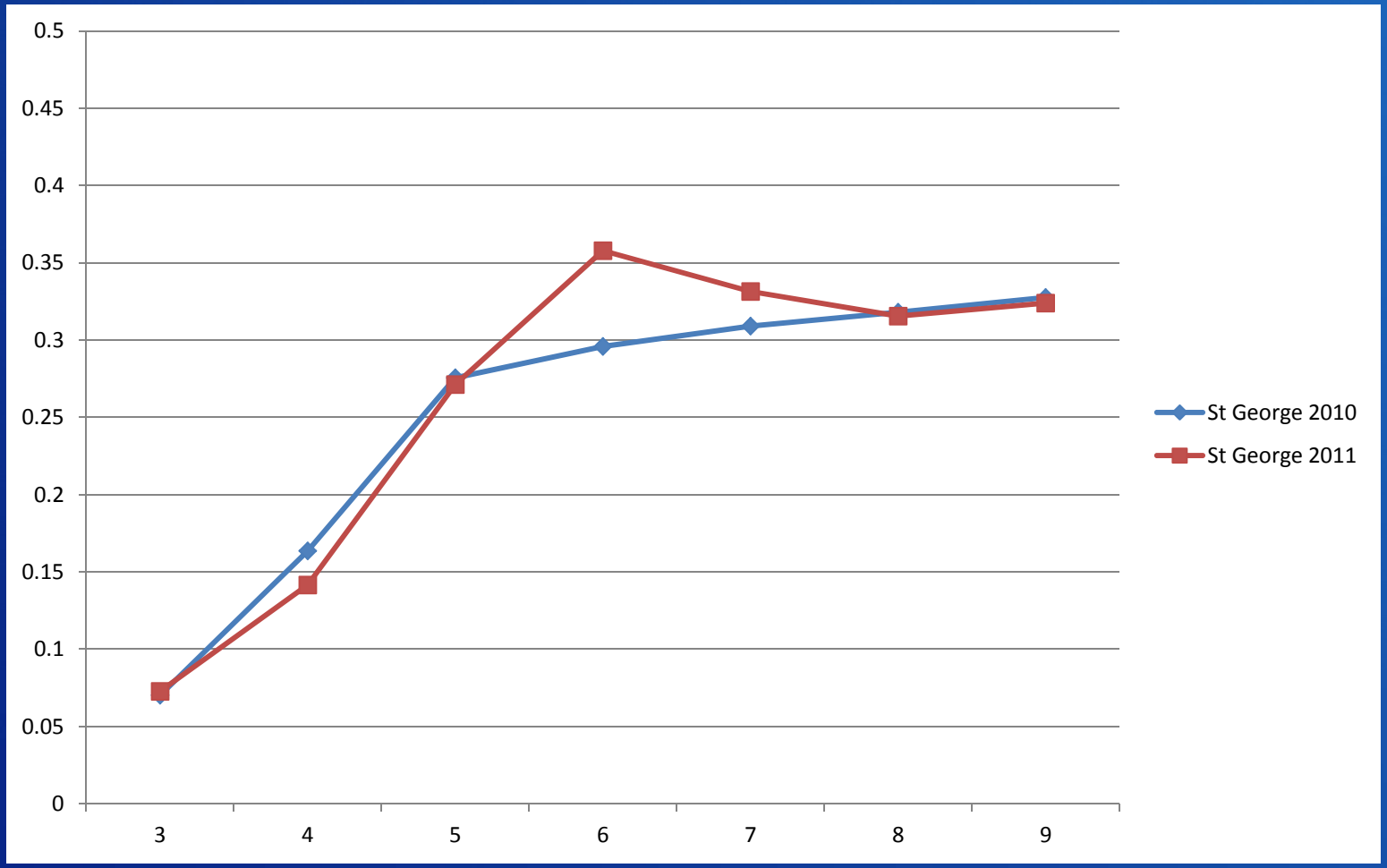
RECLAMATION

Mormon Mesa – Average NDVI 2010



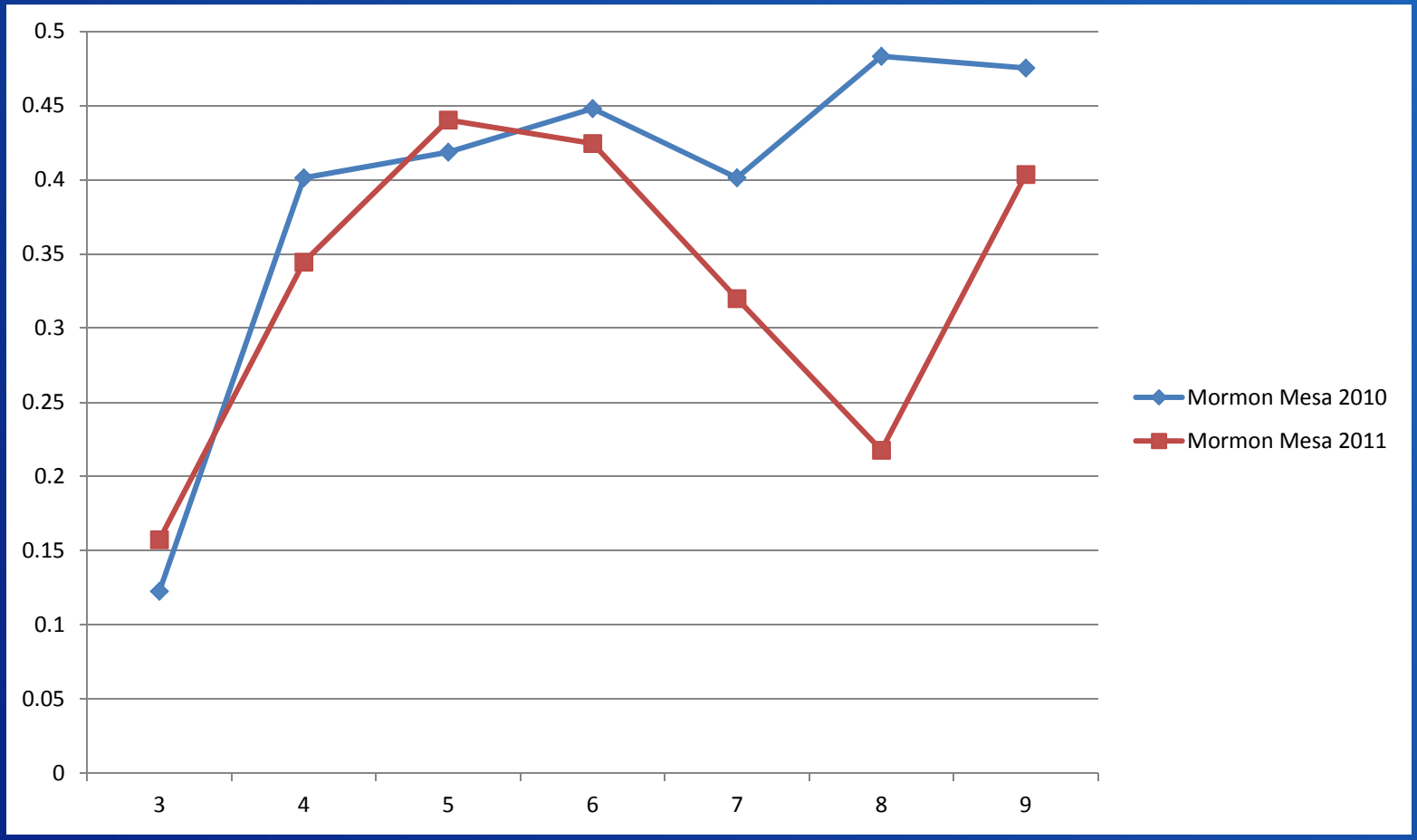
RECLAMATION

St George – Avg NDVI for 2010 / 2011



RECLAMATION

Mormon Mesa – Avg NDVI 2010 / 2011 (with Beetles)



RECLAMATION

GIS Question

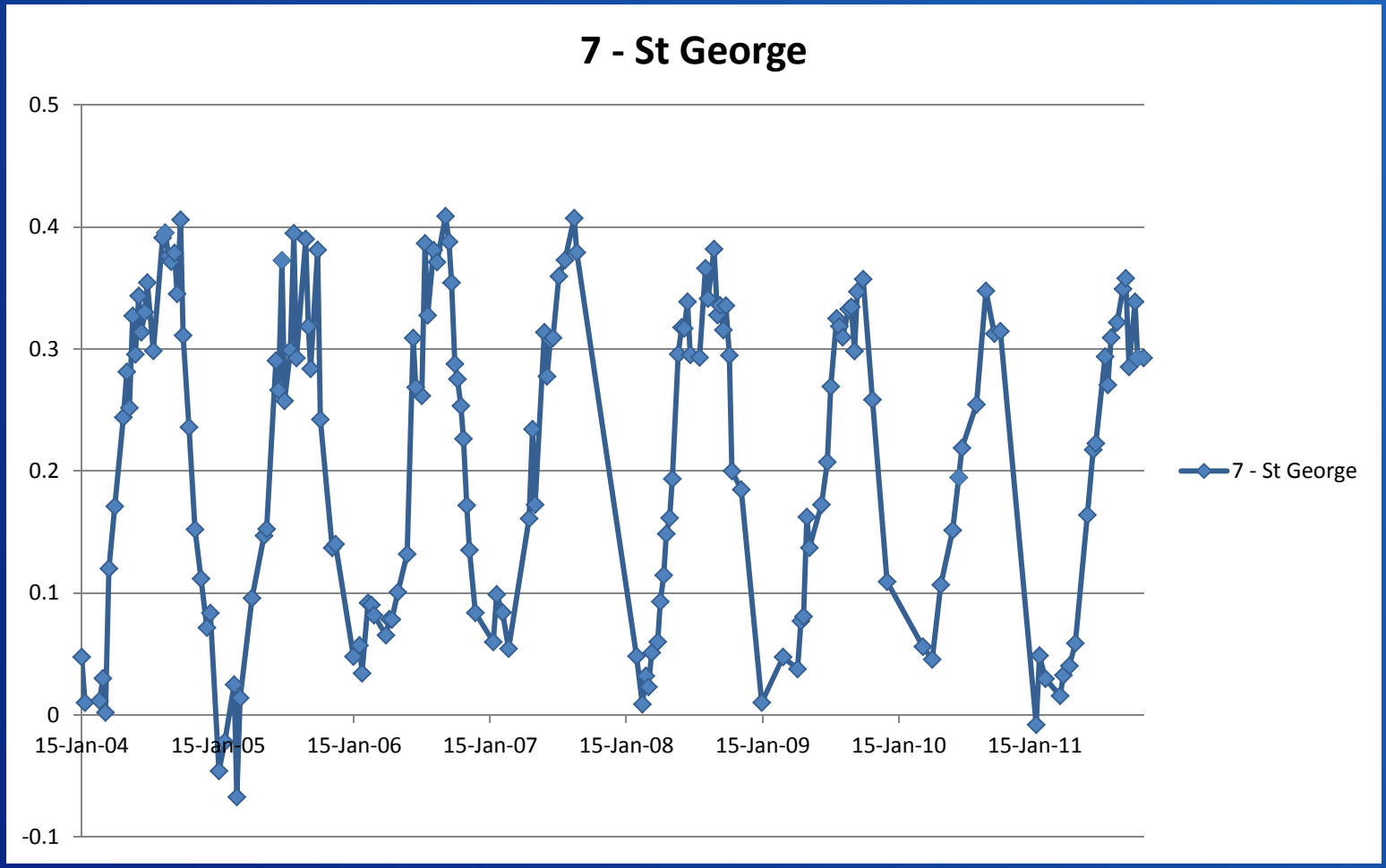
Using NDVI values from Landsat 5 data (30 m) can one detect tamarisk leaf beetles defoliation along the Virgin River 2004 - 2010

Survey Locations along the Virgin River

- **Near the town of St George**
- **Near Mormon Mesa**

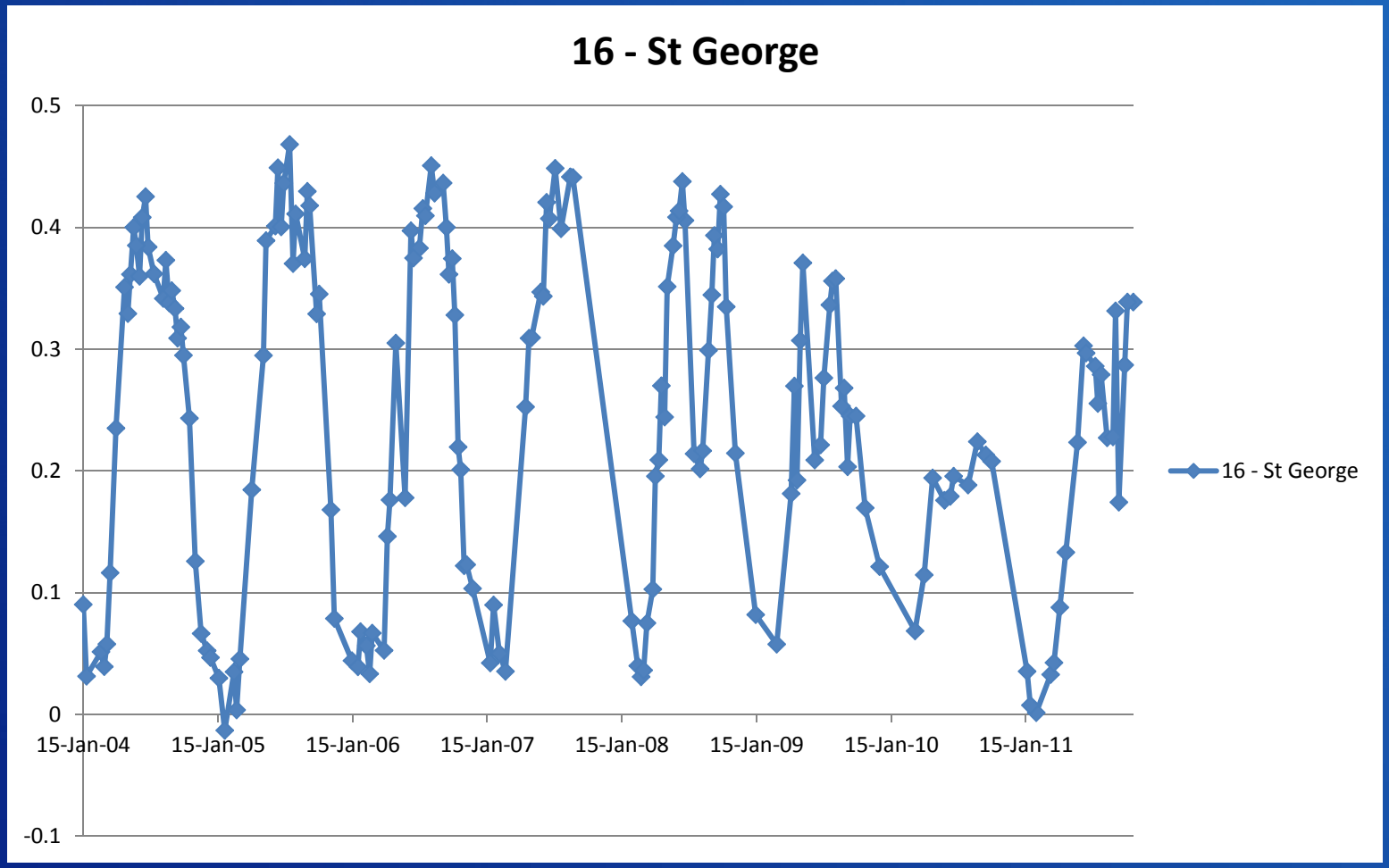
RECLAMATION

St George Point 7 – NDVI



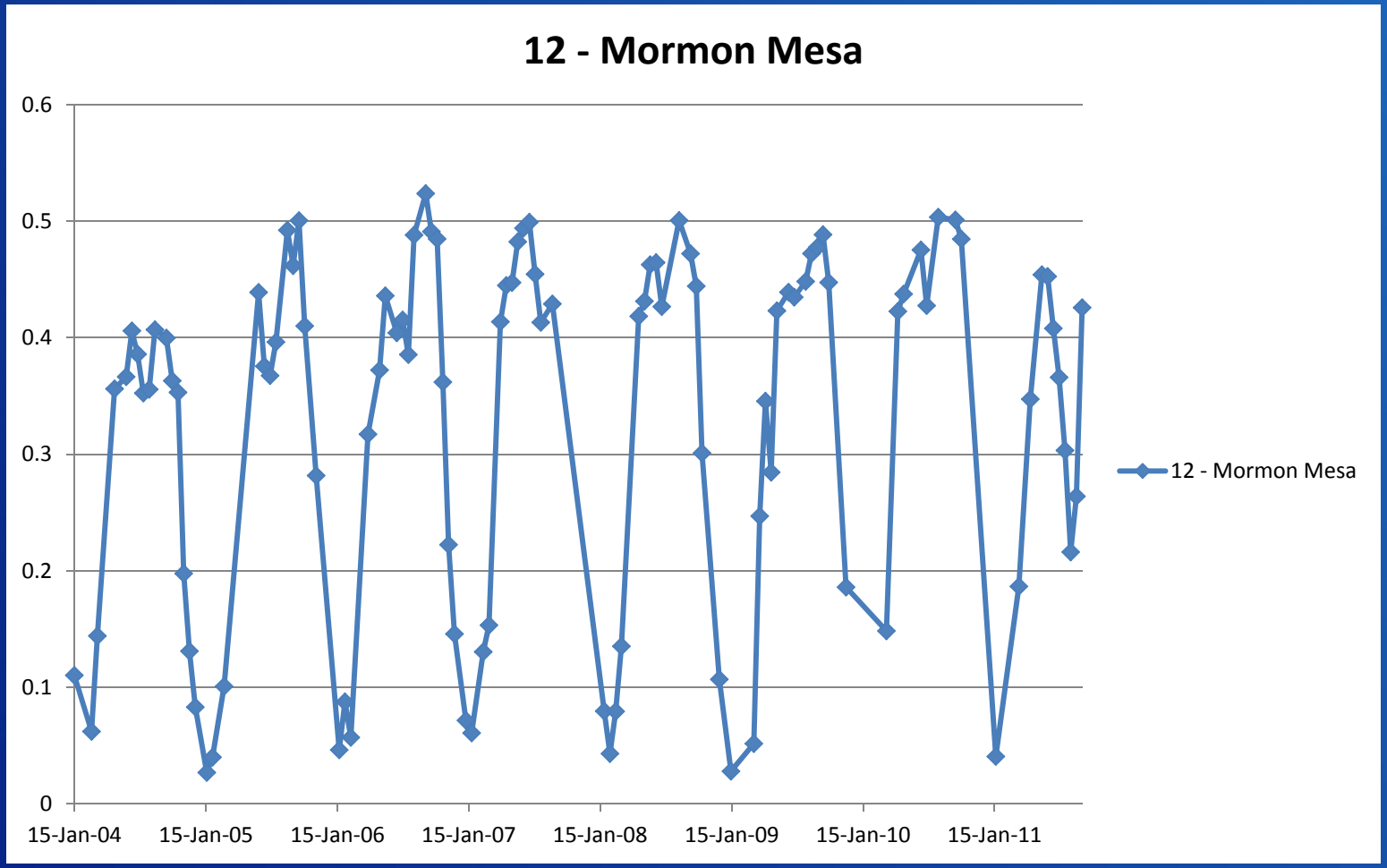
RECLAMATION

St George Point 16 – NDVI



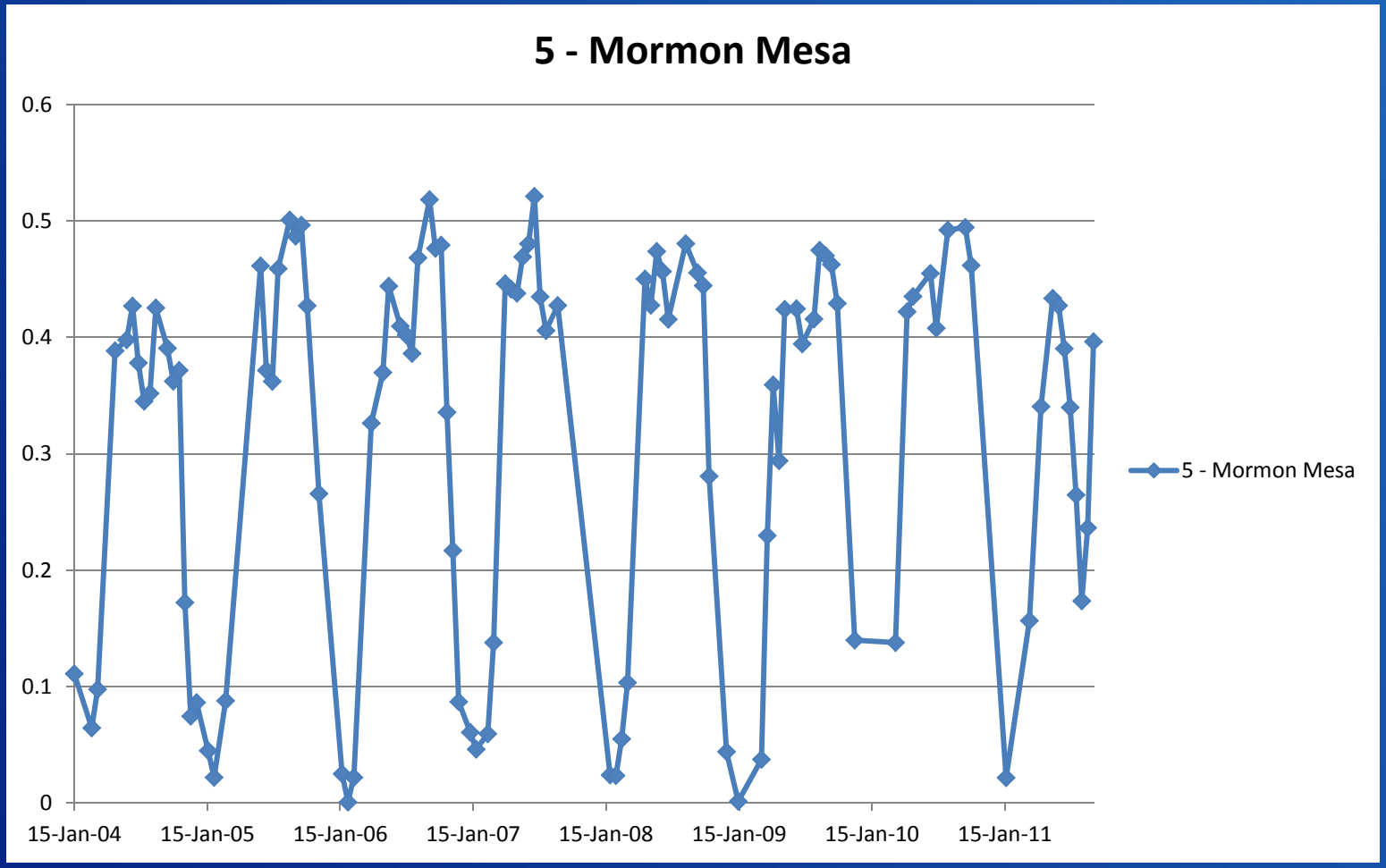
RECLAMATION

Mormon Mesa Point 12 – NDVI



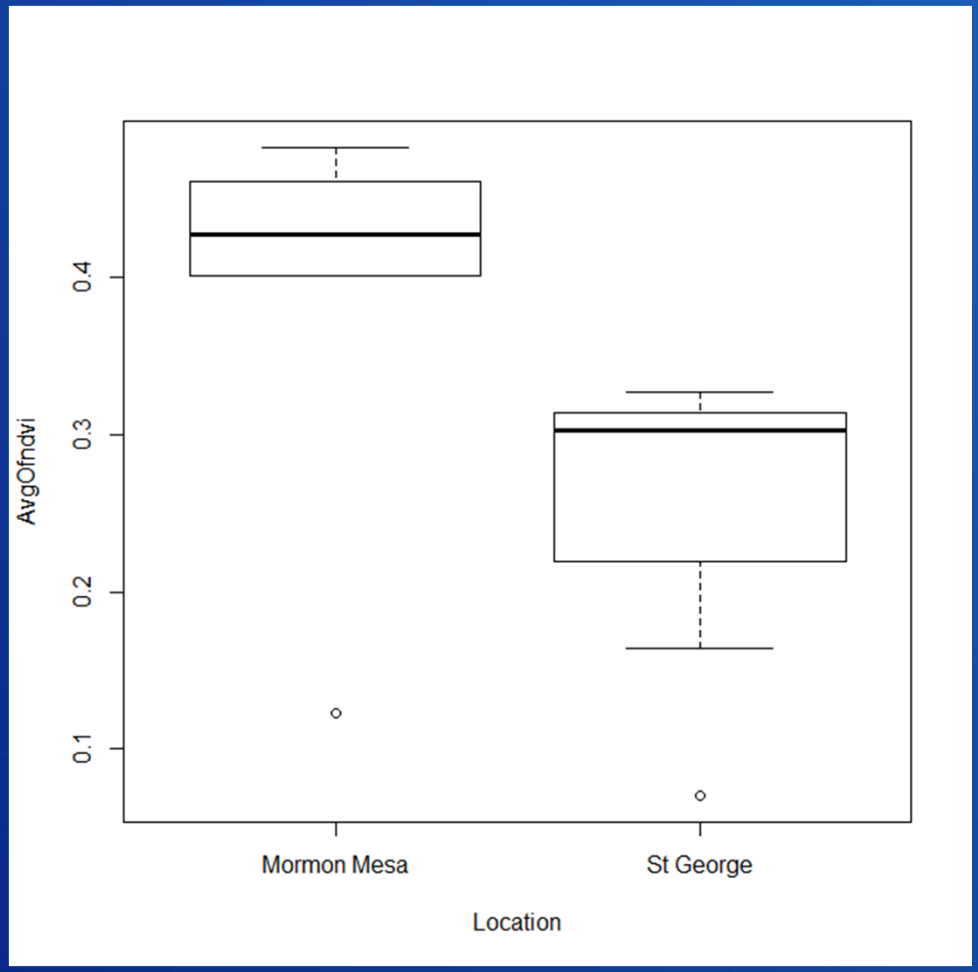
RECLAMATION

Mormon Mesa Point 5 – NDVI



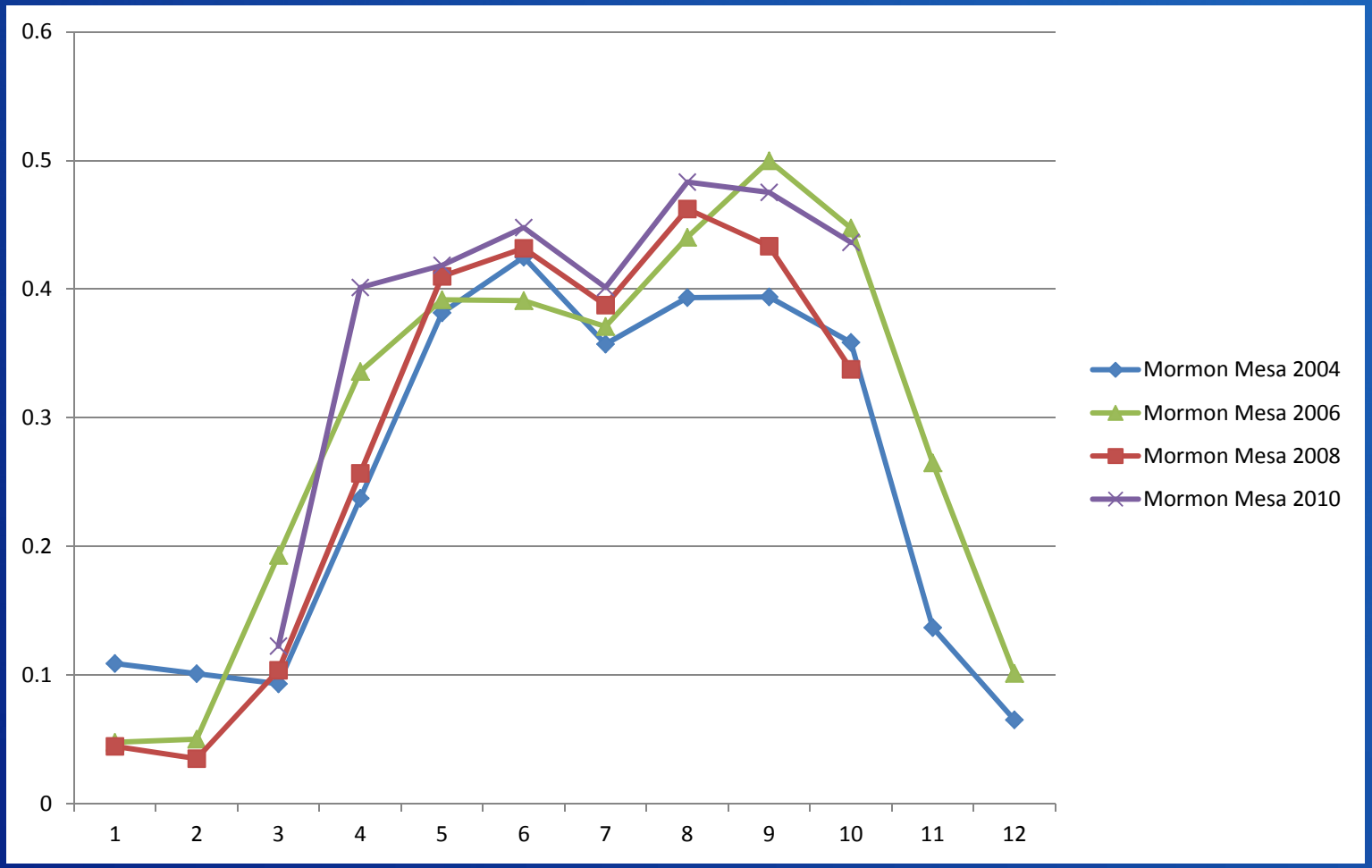
RECLAMATION

Compare Sites



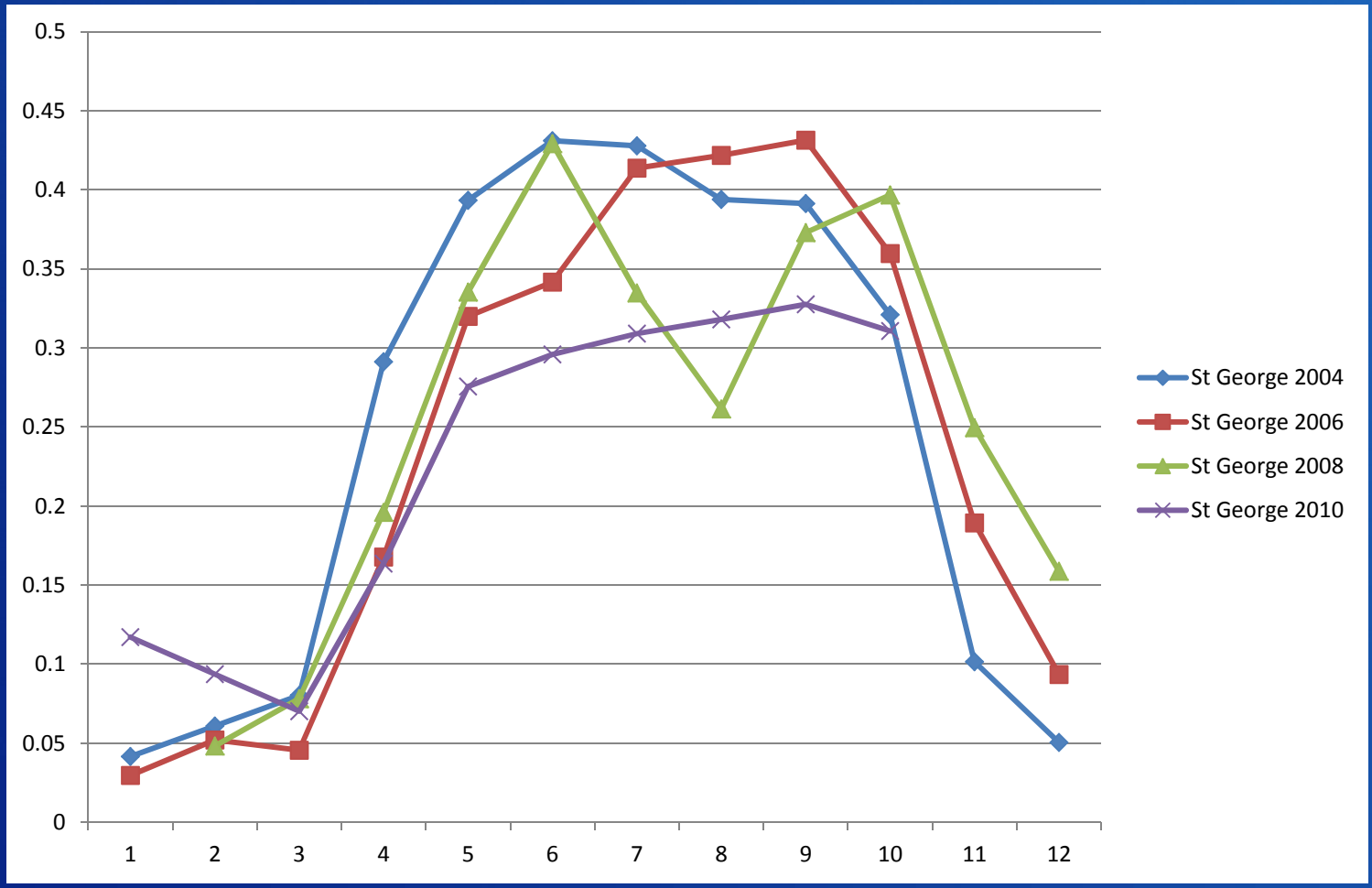
RECLAMATION

Mormon Mesa



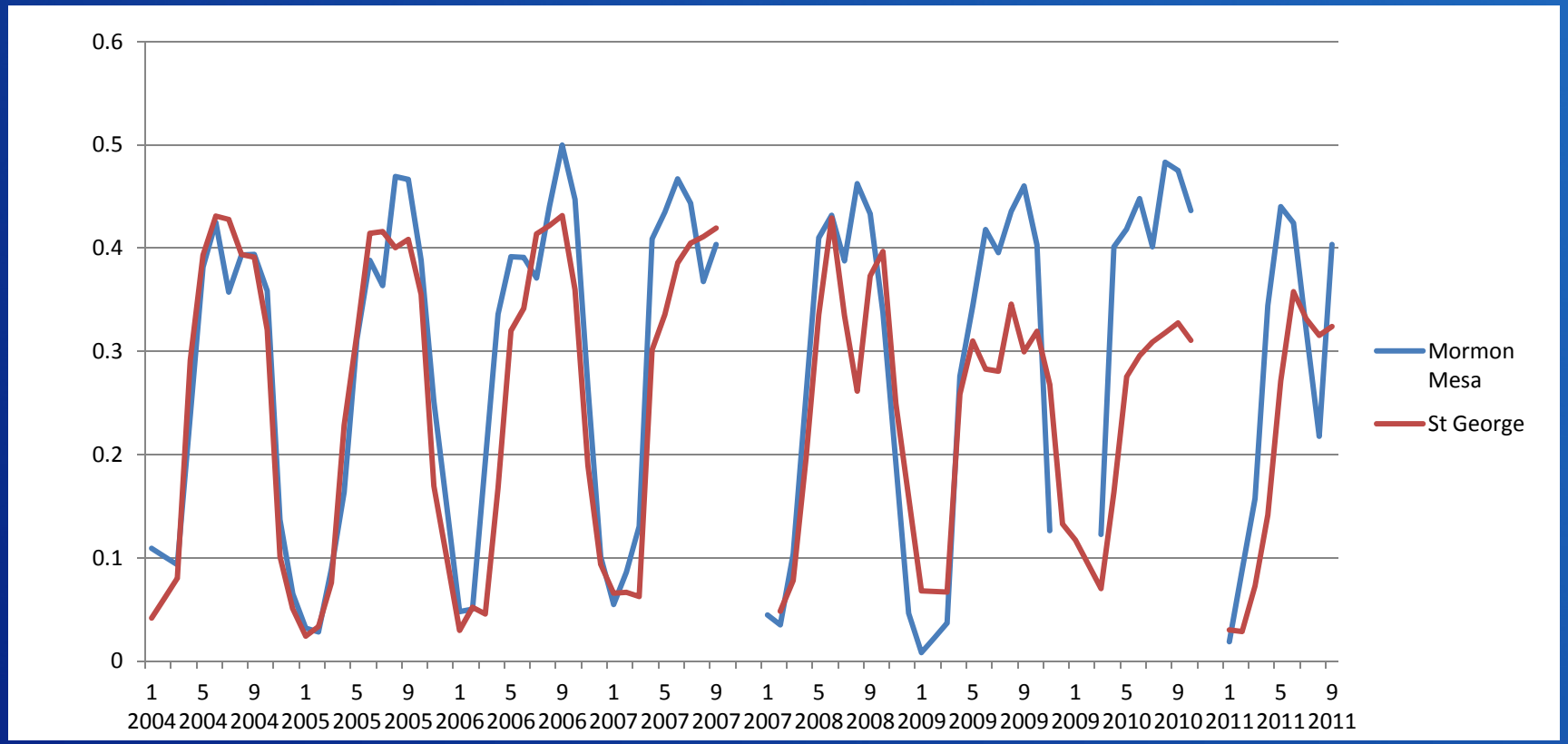
RECLAMATION

St George



RECLAMATION

NDVI 2004 - 2010



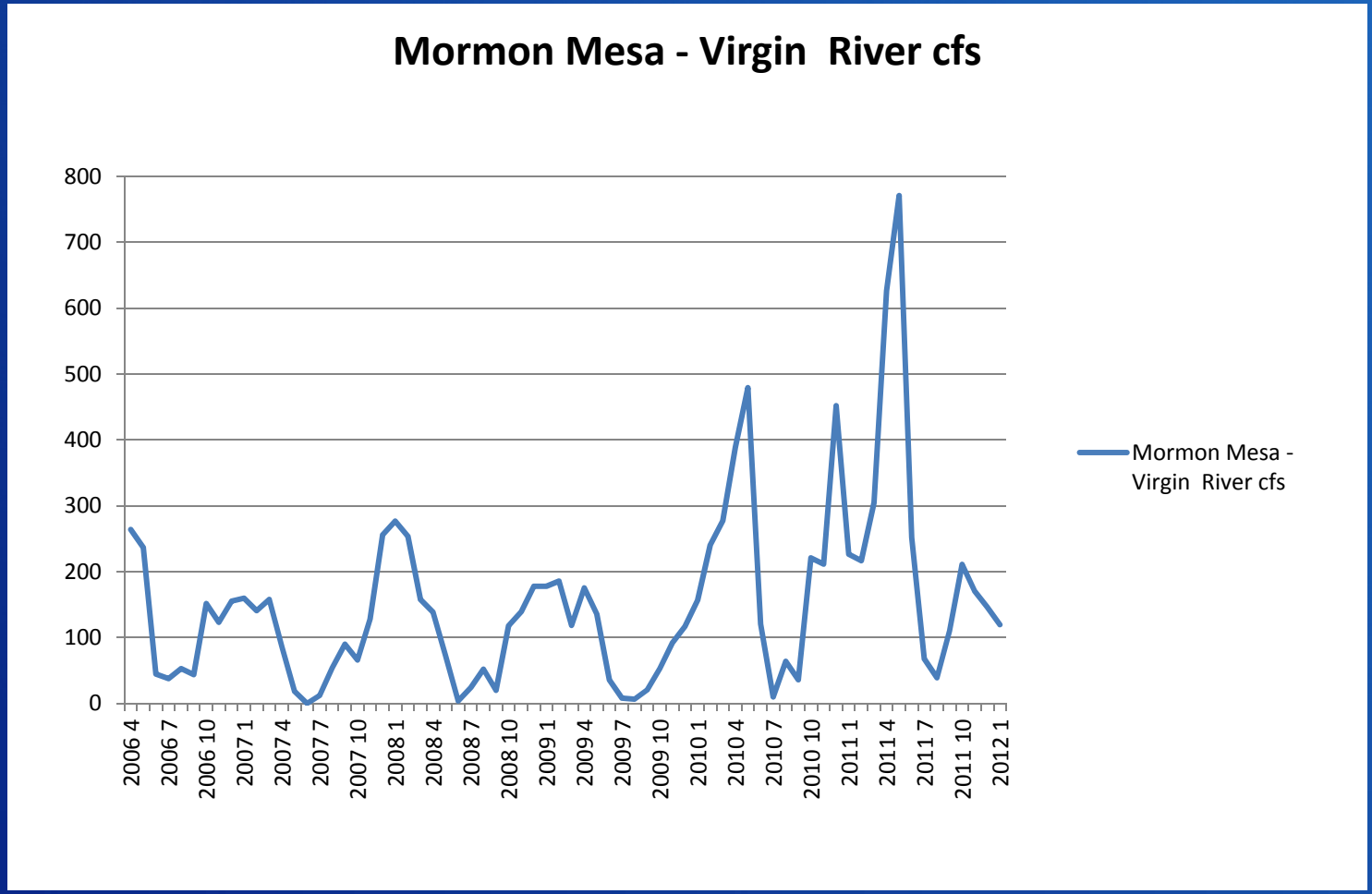
RECLAMATION

Variability in System

- Winter Rains
- Variability in Vegetation
- Virgin River Flow
- Summer Heat

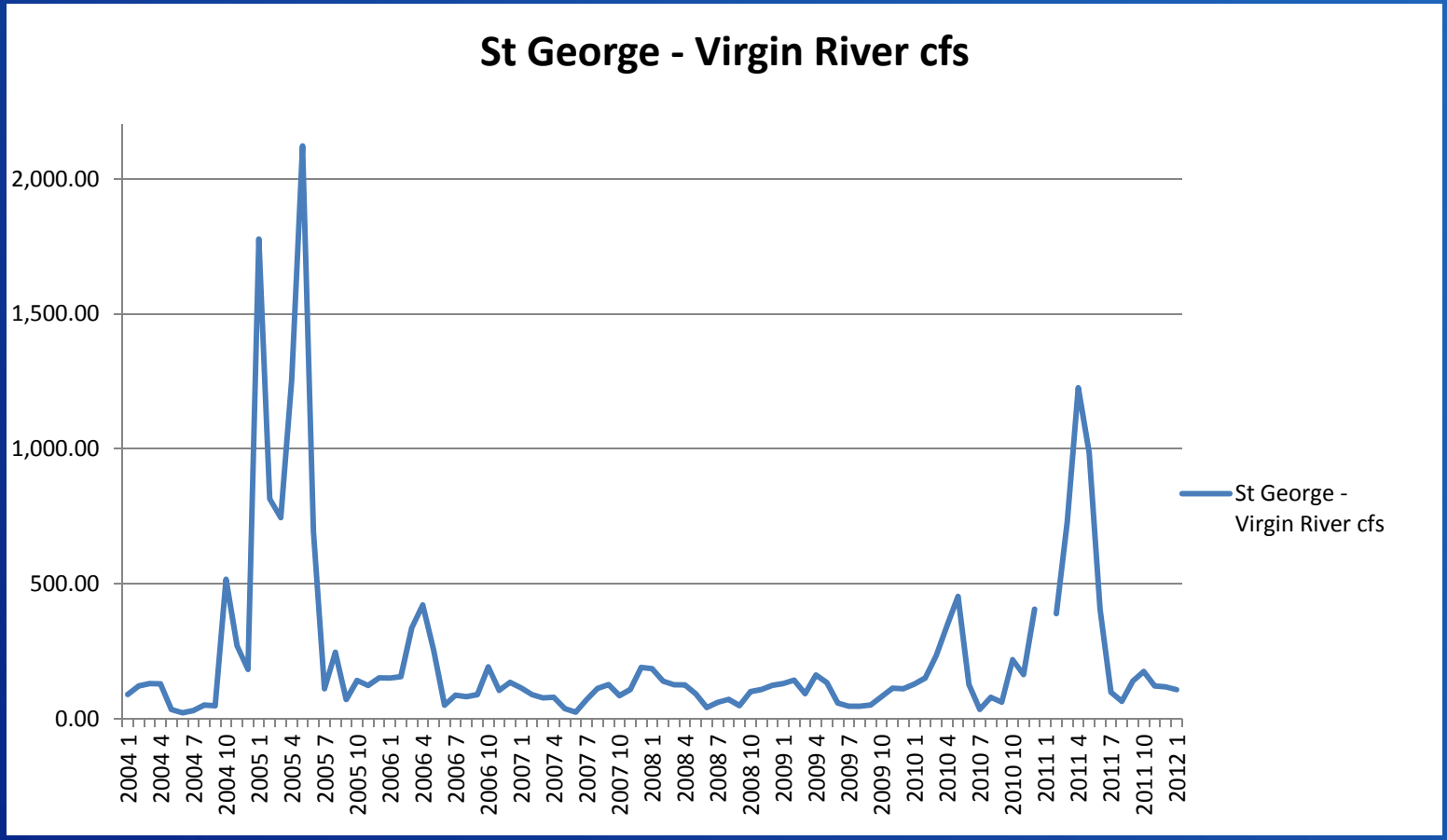
RECLAMATION

Virgin River cfs



RECLAMATION

Virgin River cfs



RECLAMATION

Problems

On November 18, 2011 USGS suspended Landsat 5 imaging activities in order to explore options for restoring satellite-to-ground image transmissions. It remains to be seen if there is any hope of salvaging the rapidly degrading electronic component of the transmitter.

RECLAMATION