Appendix D: Glen Massey CMP Assessment

REPORT

Waikato District Council

Appendix **D**
Catchment Management Plan
Glen Massey Structure Plan Area

Tonkin & Taylor

ENVIRONMENTAL AND ENGINEERING CONSULTANTS

REPORT

Waikato District Council

Appendix **D**
Catchment Management Plan
Glen Massey Structure Plan Area

Report prepared for:

Waikato District Council

Report prepared by:

Tonkin & Taylor Ltd

Distribution:

Waikato District Council	PDF
Tonkin & Taylor Ltd (FILE)	1 copy

March 2015

T&T Ref: 61814.2000

Table of contents

1 Catchment description

1.1 Location

The Glen Massey Structure Plan Area (SPA) surrounds the North Waikato township of Glen Massey, and is located approximately 10 km west of Ngaruawahia. The location of the Glen Massey SPA is presented in Figure 1. The SPA (red outline) covers approximately 74 ha of the broader 580 ha catchment (green outline).

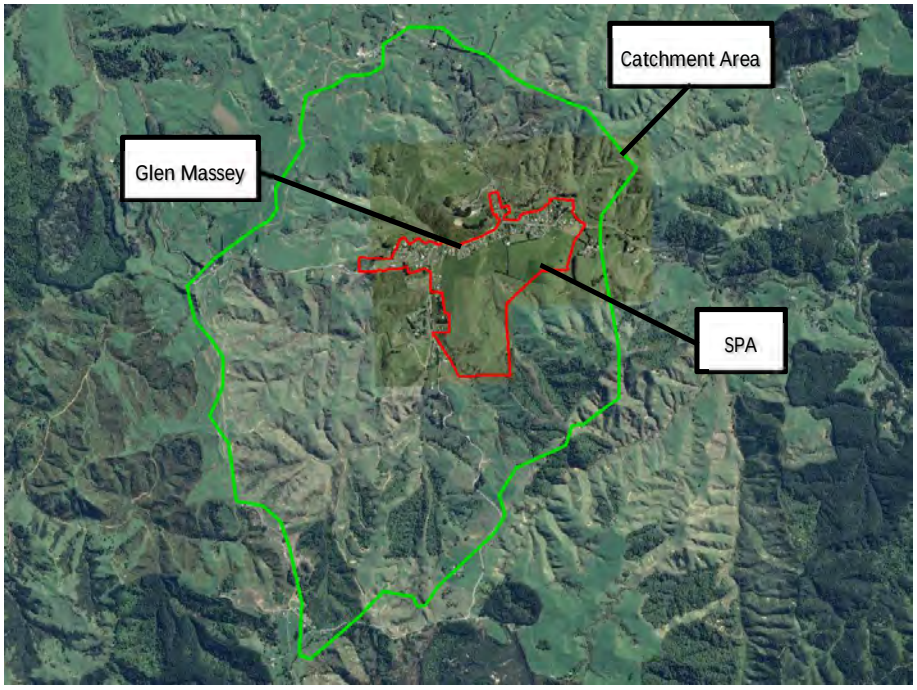


Figure 1. Glen Massey SPA and catchment location (Image sourced from Google Earth, 2014)

1.2 Topography

The topography of the catchment and SPA is typically rolling to steep hills divided by ridges and valleys with natural water courses. The SPA is located adjacent to Firewood Creek in the upper reaches of this catchment. The majority of the SPA is on the floodplain and hillside to the south of the creek. Firewood Creek generally flows from west to east through the SPA.

1.3 Geology and hydrogeology

The published geology of the area indicates that the majority of the Glen Massey SPA is underlain by hard siltstone with fine to coarse-grained sandstone (commonly referred to as greywacke) of the Newcastle Group (Edbrooke S. W., 2005) as shown in the geological map in Figure 2 below. This is overlain by Oligocene age fine to medium-grained sandstone overlying siltstones of the Glen Massey Formation, which outcrops in the elevated parts of the catchment generally to the north of Glen Massey. In the low lying (north) area of the SPA there is a small pocket of alluvial sediments of the Pleistocene age Walton Subgroup (Edbrooke S. W., 2005).

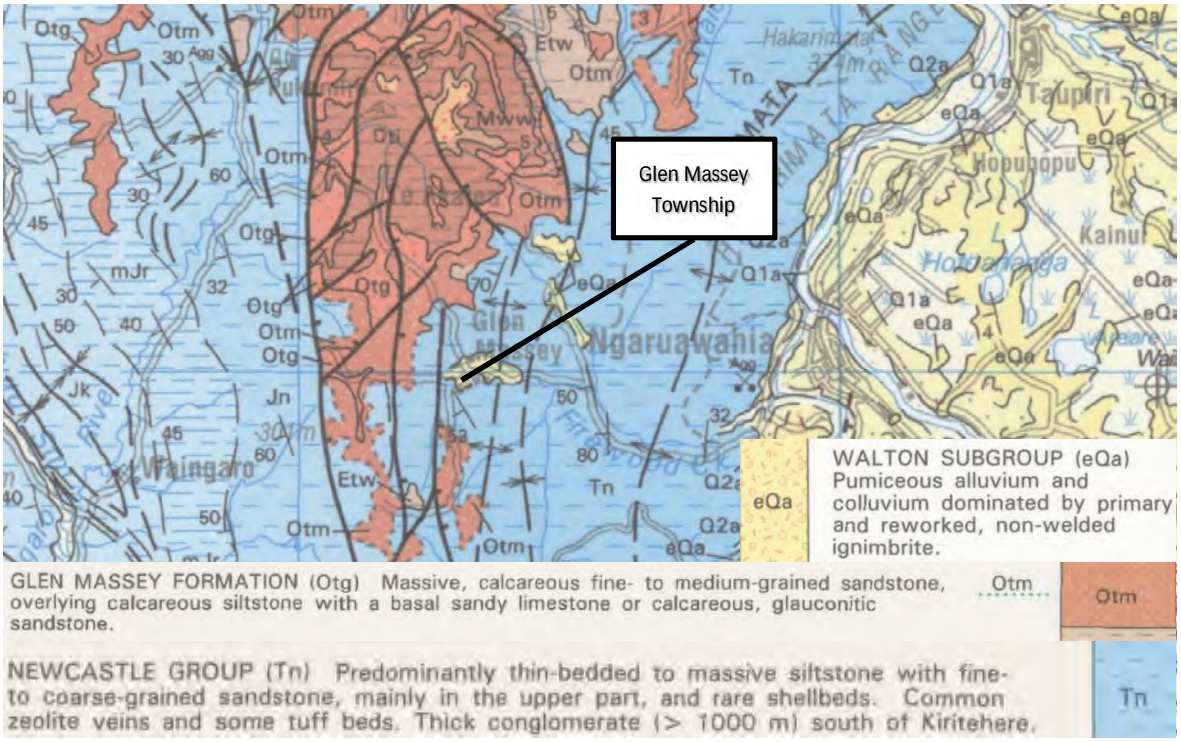


Figure 2. Geological map of Tuakau structure plan area

The hydrogeology of the area is characterised by the presence of limited quantities of groundwater in either the greywacke rocks of the Newcastle Group or calcareous siltstones, sandstones and occasional limestones of the Glen Massey Formation. Marshall and Petch (1985) consider that the rocks of the Newcastle Group and have low porosity and permeability, except in localised areas where these rocks have been fractured, resulting in moderate secondary porosity. The rocks of the Glen Massey formation similarly contain limited quantities of groundwater. This indicates that groundwater flows are likely to be limited and form a small proportion of the overall water balance for the area.

Recharge of groundwater is likely to be limited to infiltration of rainwater onto relatively steep land, where surface runoff is more dominant.

1.4 Watercourses

There is one main watercourse flowing through the existing Glen Massey Township; Firewood Creek. Firewood Creek runs through the Township within an incised channel receiving runoff from the north, south and west, before discharging to the east. The creek drains both agricultural and residential land that make up the SPA. The middle reach of Firewood Creek runs through the low lying areas of the SPA. After exiting the SPA Firewood Creek drains to the east before discharge to the Waipa River some 10km downstream.

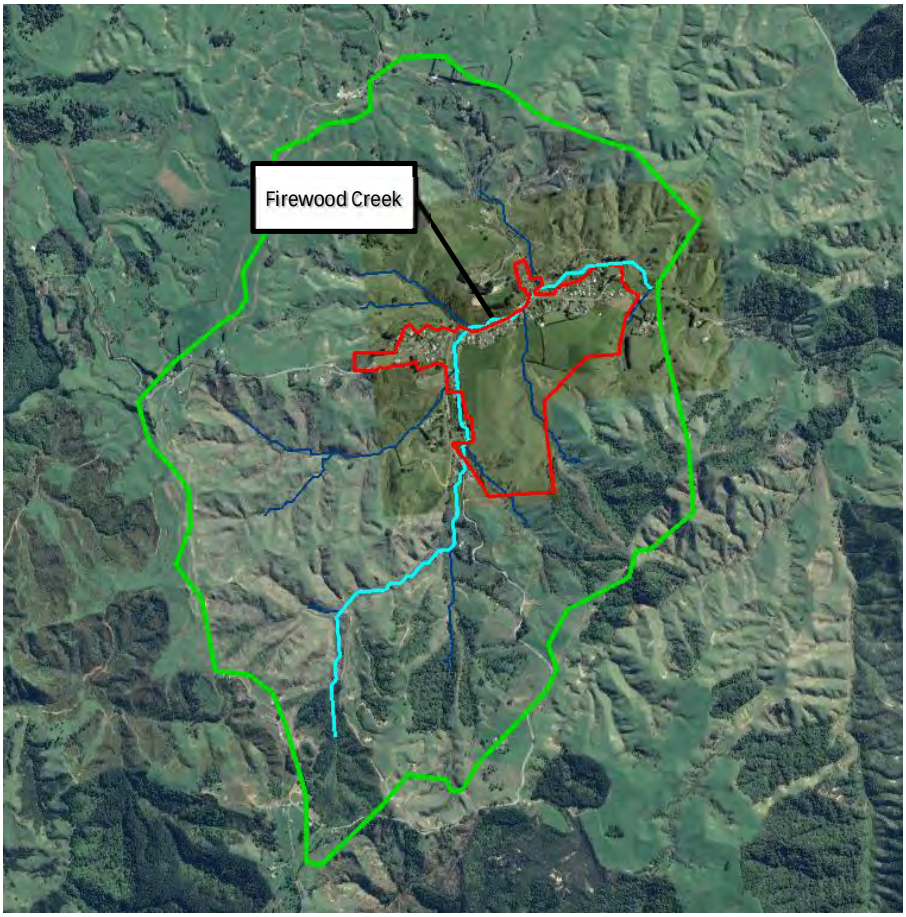


Figure 3. Firewood Creek (light blue) and tributaries (dark blue) within the catchment.

There are a number of unnamed tributaries within the Glen Massey SPA that discharge to Firewood Creek. The unnamed tributaries drain predominantly agricultural and a small amount of residential land and are shown in Figure 3.

1.5 Receiving environments

The identified surface water receiving environments within or adjacent to the Glen Massey SPA include:

- Firewood Creek
- Unnamed tributaries of Firewood Creek

1.6 Existing WRC resource consents

1.6.1 General

WRC's online database has been used to broadly identify the types of resource consents held within the SPA and these are summarised in Table 1 below.

Table 1. WRC Resource Consents

Resource Consent Type	Number
Discharge - Air	Nil
Discharge - Land	Nil
Discharge - Water	Nil
Land Use – Bore/Well	Nil
Land Use – Other	2
Water Take - Ground	Nil
Water Take - Surface	Nil
Water Take - Other	Nil

1.6.2 Comprehensive stormwater discharge consent

Waikato District Council holds Resource Consent No. 105655, being a Comprehensive Stormwater Discharge Consent (CSDC) associated with urban Glen Massey.

Relevant extracts from the resource consent are reproduced below:

Consent Type: Discharge permit

Consent Subtype: Discharge to land and water

Activity authorised: To divert and discharge urban stormwater and associated contaminants at multiple locations to land and Firewood Creek, the Waipa River, and use discharge structures, within the Glen Massey urban area.

Consent duration: Granted for a period expiring on 22 September 2028

It is noted that the extent of the above consent (reticulated urban area of Glen Massey) is significantly smaller than the extent of the SPA.

2 Land use in Glen Massey

2.1 Current land use

Land within the SPA is dominated by agricultural land uses, with the residential Glen Massey Township and rural residential outskirts also occupying a significant portion of the total area. There are negligible other land uses currently occurring within the SPA. The residential area of the Glen Massey Township is located in the northern part of the SPA with predominantly agricultural land surrounding it to the south.

A key arterial route to the north and south is Waingaro Road, which is the only transport corridor giving access to the township.

2.2 Future land use

The future growth in Glen Massey has not been specified by WDC. This CMP therefore only generally assesses the areas within the SPA and highlights areas that are not suitable for future growth.

3 Ecological review

This section presents the results of our review and assessment of the ecological status of stream resources in the Glen Massey SPA. The assessment is based on a review of existing ecological information with a brief site visit to publicly accessible parts of the SPA.

3.1 SPA overview

3.2 Assessment methods

There has been no ecological assessments of Glen Massey and its surrounds provided by Waikato District Council. Our assessment has reviewed the information available in national and regional ecological databases.

In addition, a site walk over of streams at publicly accessible locations was conducted by a T&T ecologist on 9 April 2014 to confirm levels of development, observe in stream structures, assess fish passage conditions and visually assess habitat condition. The sites assessed during the field assessment are shown on Figure 292 in Appendix DA.

3.3 Summary of existing ecological information

3.3.1 Operative District Plan

The Operative Waikato District Plan and associated maps were reviewed for any ecological features of note. The Glen Massey SPA is included on Planning Map 19.3. There was no ecological features of note within the Glen Massey SPA.

3.3.2 Waikato Regional Plan maps

Waikato Regional Plan (WRP) water management and stock exclusion maps were reviewed to check for any specific values that apply to SPA streams. All watercourses within the area are classified as Waikato Surface Water (Map S14) and will be subject to the relevant standards in Section 3.2 of the WRP in regard to discharges of contaminants.

Firewood creek directly downstream from Glen Massy is classified as Indigenous Fisheries and Fish Habitat, and Trout Fisheries and Trout Spawning Habitat. This classification is applied to significant habitats or areas that are characterised by high water quality.

From the downstream end of the SPA to its headwaters, the unnamed tributaries of Firewood Creek are approximately 13.0km long with approximately 11.0km (85%) upstream of the SPA boundary.

3.3.3 T&T's 2014 field assessment

A site inspection of publicly accessible locations on Firewood creek and its unnamed tributaries in the Glen Massy SPA was conducted on 9 April, 2014. Locations inspected are shown on Figure 292 in Appendix DA.

Observations from site inspections concluded that streams where typically open with limited areas of riparian vegetation providing shade to the stream bed. The stream bed was dominated by gravels and small cobble sized sediments embedded in fine silts and sands. There was excessive periphyton growth in unshaded areas. Upper catchment land use is a mix of agriculture and regenerating vegetation which likely contributed to the excessive periphyton growth.

In-stream habitat at the sites inspected was generally diverse with a range of habitats including riffles, runs and shallow pools, with good connectivity to the flood plain in upstream areas of the SPA. A short section of stream along Wilton Collieries Rd has undergone channel modification and is now a straightened U shaped channel.

A barrier to upstream fish passage was identified at the culvert under Wilton Collieries Rd east of the intersection with Kereru Rd. This culvert has previously been retrofitted for fish passage but a small concreate lip on the downstream end would prevent the migration of non-climbing fish species such as inanga during low flows. It is noted that inanga and longfin eel are present in all catchment streams and are classified as At Risk: Declining (Goodman, 2014).

4 Ecological assessment

4.1 Introduction

This section provides an assessment of the potential effects of development of the Glen Massey SPA on surface water resources. The assessment has considered the general issues outlined within Section 2 of the main report and provides an assessment of the significance of these issues for growth.

We note that WDC has not provided any indication of the types of future land use within Glen Massey, so for the purposes of this assessment, we have assumed that any growth in Glen Massey would be low density residential.

4.2 Assessment of effects

The main ecological issues associated with future urban development in the Glen Massey SPA are described below and the significance of possible future development to a range of issues for each is presented in Table 2.

Table 2. Significance of potential adverse effects from proposed development

Future development	Low density residential
Issue	
Stormwater	
Contaminants[1]	Low
Increase in peak flows leading to stream bed/bank erosion	Low
Hydrological	
Reductions in base flow[2]	Low
Reduction in flow variability leading to reduced habitat quality	Low
Habitat	
Culverting or infilling of perennial streams reducing habitat	Medium
Protection of riparian margins	Low
Barriers to fish movement	Low
Overall potential adverse effect on surface water	Low

5 Flood analysis

5.1 Introduction

A Culvert Capacity Analysis (CCA) has been undertaken. The purpose of the CCA was to determine culvert capacity and also to approximate levels of inundation within and surrounding the incised stream due to the culvert obstructions. An engineering survey to determine key levels and CCA was performed due to the absence of LiDAR making it impossible to undertake the previously proposed Rapid Flood Hazard Assessment. The CCA provides information to indicate where flooding hazards may occur and is considered a 'rough order' estimate of flood extents only.

5.2 Methodology

5.2.1 Waterways and culverts

WDC did not provide any information on any bridges or significant culverts within the catchment.

Stormwater from the township is generally directed via open drains to tributaries of Firewood Creek, or directly into the creek itself. As there was no ground level or asset data available, two site visits were undertaken to establish critical stormwater asset level and approximate ground levels at some locations. These site visits were undertaken on 9 April 2014 and 15 May 2014.The culvert information gathered during site visits is outlined below.

In total four culverts were identified that have the potential to influence the stream and cause flooding to adjacent property within the SPA. The location of these culverts is shown on Figure 4.

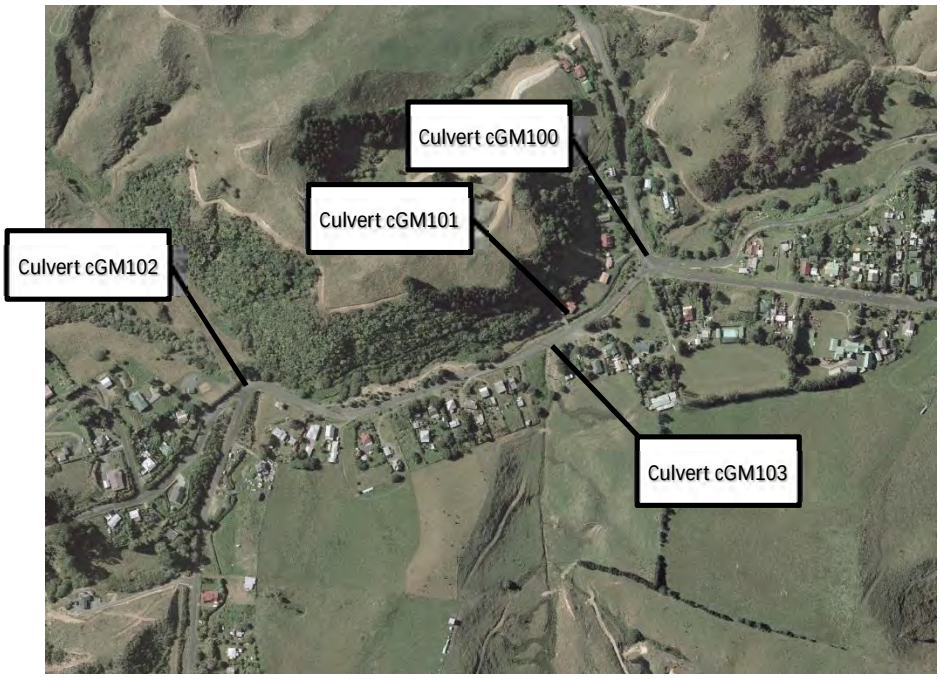


Figure 4: Culvert locations

Culverts cGM100 to cGM102 are located on Firewood Creek, while Culvert cGM103 is located on an unnamed tributary of Firewood Creek.

Culvert cGM100 is located under Waingaro Road and has the largest catchment.

Culvert cGM101 is located just upstream of cGM100 under a private access way.

Culvert cGM102 is located upstream of cGM101 underneath Wilton-Colleries Road.

Culvert cGM103 is located on a tributary of Firewood Creek underneath Wilton-Colleries Road, the culvert discharges directly to Firewood Creek above cGM101.

Culvert details were obtained using a GPS and dumpy survey. All measurements and levels obtained are approximate only with a likely margin of error of +/- 0.3m in the vertical and +/-1.0m in the horizontal. Vertical datum is approximates Moturiki Vertical Datum based on GPS survey only as no suitable LINZ survey benchmarks were available. The culvert information is summarised in Table 3 .

Table 3: Culvert properties

Culvert	Type	Diameter/ width (m)	Upstream invert (mRL)	Downstream invert (mRL)	Length (m)	Road overtopping level (mRL)
cCGM100	Corrugated iron with concrete base	4.25	126.20	125.98	21	129.30
cCGM101	Corrugated iron	2.2	126.74	126.66	8	129.67
cCGM102	Concrete	0.75	128.17	128.17	18	129.62
cCGM103	Corrugated iron with concrete base	3.45	129.85	129.76	14	132.46

We understand that culvert information may be available on WDC's RAMM database but these were not available at the time of this assessment.

5.2.2 Hydrology

Hydrologic modelling of the catchment areas has been carried out using the SCS curve number method as prescribed in Technical Publication 108 (Auckland Regional Council, 1999).

5.2.2.1 Catchments

Culvert catchment boundaries and flow paths were adopted based on REC (NIWA, 2004) database 1st Order catchments and classifications. The catchment boundary for cGM100 (indicative only) is shown in Figure 5 below. This catchment is the largest of the four and encompasses the other three culvert catchments.

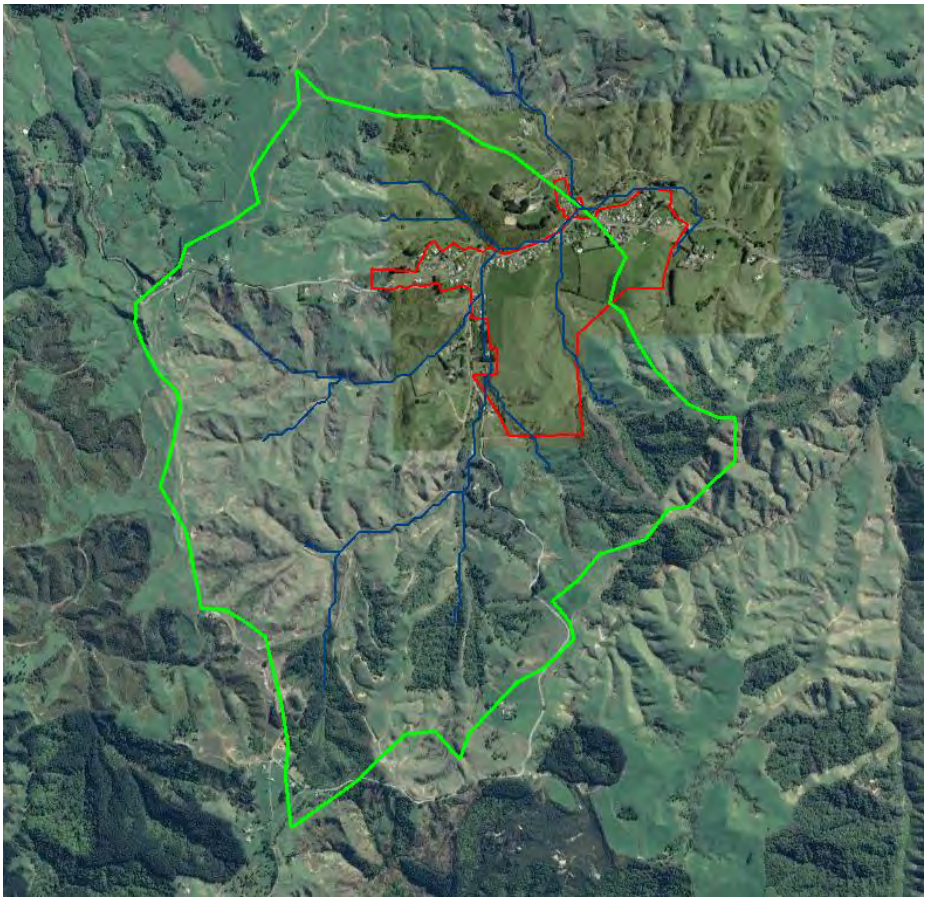


Figure 5. Indicative catchment boundary for CCA

The slope within each catchment was determined using the equal area method and 30 m contours obtained from Terraview software. The catchment properties for each culvert are shown in the table below.

Table 4: Catchment properties

Culvert catchment	Area (Ha)	Flowpath length (m)	Slope (m/m)
cGM100	580	3884	0.02
cGM101	573	3730	0.02
cGM102	407	3390	0.03
cGM103	69	1640	0.04

5.2.2.2 Underlying geology and land cover

Aerial photography and satellite imagery from Google Earth has been used to determine percentage land cover.

Land cover has been approximated at 90% pasture and 10% bush, with the hydrologic condition of this cover assumed as fair and good respectively. The underlying soil has been estimated at 5% group B soil (moderate-high soakage) and 95% group C soil (low-moderate soakage).

It was assumed that all catchment areas were pervious, and the presence of buildings and roads was negligible. An initial abstraction of 5mm was applied to all catchment areas.

5.2.2.3 Rainfall

The 24 hour rainfall depth for a 1%, 10% and 50% AEP design storms was obtained using NIWA's HIRDSv3 online rainfall inventory based on the approximate centroid of the catchment. Although the 1% AEP is the critical design storm, the other design storms were analysed for comparison. To incorporate climate change, the rainfall depth was then increased by applying a 3 degree Celsius temperature increase within the HIRDSv3 inventory. An increase of 3 degree Celsius has been adopted in accordance with unpublished guidance from WRC. The 24 hour rainfall depths are shown below:

- 1% AEP 218.7 mm
- 10% AEP 129.5 mm
- 50% AEP 83.5 mm

5.2.3 Hydraulics

The CCA involved hydraulic modelling of the culverts and overtopping of these culverts where applicable.

5.2.3.1 Culverts

The capacity of identified culverts was analysed using CulvertMaster software. Properties for the culverts were taken from the site visit as summarised in Table 3. Flows at each culvert were taken from the hydrologic analysis.

Tail water levels were assumed to be defined by the culvert obvert at the downstream end. Where the required headwater for a culvert to pass a flow was above road or access way overtopping levels at that culvert, flow through the culvert was limited and excess flow was assumed to be flowing over the above road or access way.

5.2.3.2 Road overtopping

Headwater levels of flows in excess of culvert capacity (above road or access way crown) were analysed as a weir using FlowMaster software. All weirs were assumed to be v-notch weirs with an angle of 176 degrees and a discharge coefficient of 0.57 and were also checked using a broad crested weir calculation. Road overtopping was analysed at all culverts. Tail water levels at cGM101 and cGM102 were assumed to be defined by the headwater level at cGM100 and cGM101 respectively.

5.2.3.3 Buildings

WDC provided building footprints in the district but no information on any floor levels.

5.3 Results and discussions

5.3.1 Analysis review

Results of the analysis are shown below in Table 5. Flow to the culverts is significantly higher than culvert capacity at road/access overtopping level. Indicative overtopping levels at each culvert are also provided in the summary table.

Table 5: Analysis results

Culvert	1% AEP Flow (m^3/s)	Culvert capacity at overtopping (m^3/s)	Overtopping water level (approximate mRL)
cGM100	72.9	26.3	130.5
cGM101	72.7	12.6	131.0
cGM102	55.2	1.2	131.1
cGM103	12.6	17.8	133.5

5.3.2 Rough order flood extent

The rough order flood extent has been approximated only based on the analysis results and site visits. Due to lack of a detailed ground elevation data, the accurate flood extent or flood hazard could not be quantified.

The rough order flood extent map has been produced using estimated flood levels, interpolation between surveyed ground levels and photo records. The flood extent is rough order only and should not be used for any building consent or detailed land planning purposes. The rough order flood extent is shown in Figure 282 in Appendix DA.

Building footprints supplied by WDC are shown on the flood maps presented in Appendix DA. Where the flood extent encroaches on a building footprint we consider that the buildings are potentially flood prone, however building floor levels are unknown and therefore the number of buildings actually affected by flooding cannot be determined.

6 Flooding assessment

This section presents the results of our review and flooding assessment of the Glen Massey SPA. The assessment is based on results from a Culvert Capacity Analysis (CCA) and a brief site walkover of selected parts of the SPA.

6.1 Assessment methods

6.1.1 Existing documentation

No existing documentation was available.

6.1.2 CCA

A Culvert Capacity Analysis (CCA) was undertaken for the Glen Massey SPA for a 1% AEP (plus climate change) storm event to identify flood hazards.

6.1.3 Infrastructure

Critical infrastructure within or affecting the Glen Massey SPA is summarised in Table 3 of this report. This infrastructure will likely restrict the flow of major overland flow paths, watercourses or streams. Refer to Figure 282 in Appendix DA which shows the locations of these restrictions.

6.1.4 Drainage operational issues and flooding

No drainage issues or flood reports were noted or provided by WDC. WDC have not indicated any properties effected by flooding.

6.2 Summary of flooding issues

This section provides an assessment of the potential effects of flooding on the Glen Massey SPA. The assessment includes an evaluation of flood hazards on existing residential development, and on the capacity of infrastructure critical to managing flood hazard within the SPA.

A summary evaluation of the issues is presented in Table 6.

Table 6. Summary of flooding issues

Flooding Assessment	Upstream of culvert CGM100	Upstream of culvert CGM101	Upstream of culvert CGM102	Upstream of culvert CGM103
Existing buildings within significant flood hazard?	Yes	No	No	Yes
Growth area affected	N/A	N/A	N/A	N/A
Existing critical infrastructure	CGM100	CGM100, CGM101	CGM100, CGM101, CGM102	CGM103
Overall constraint[1]	Low	Low	Low	Low

1. Based on area estimated to be affected by flooding compared to the SPA area.

6.3 Information gaps

Through our review of available information and our assessment of issues and constraints we have identified the following information gaps:

- Historical flooding information for Glen Massey.
- A detailed ground elevation model or topographic survey so that flood extents could be more accurately determined.
- Similar to above, information on waterway dimensions is required to enable more detailed modelling.
- Existing building floor levels to clarify potential flood vulnerability.
- Any information on future growth areas including road layout and waterway crossings.

7 References

Auckland Regional Council. (1999). *Technical Publication 108 Guidelines for stormwater runoff modelling in the Auckland Region.* Auckland: Auckland Regional Council.

Edbrooke, S. W. (2005). *Geology of the Waikato area.* Lower Hutt: Institute of Geological & Nuclear Sciences.

Goodman, J. (2014). *Conservation status of New Zealand freshwater fish, New Zealand Threat Classification Series 7 .* Wellington: Department of Conservation .

NIWA. (2004). *New Zealand River Environment Classification.* Wellington: Ministry for the Environement.

White, P. A., & Rosen, M. R. (2001). *Groundwaters of New Zealand.* Wellington: New Zealand Hyrological Society.

8 Applicability

This report has been prepared for the benefit of Waikato District Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

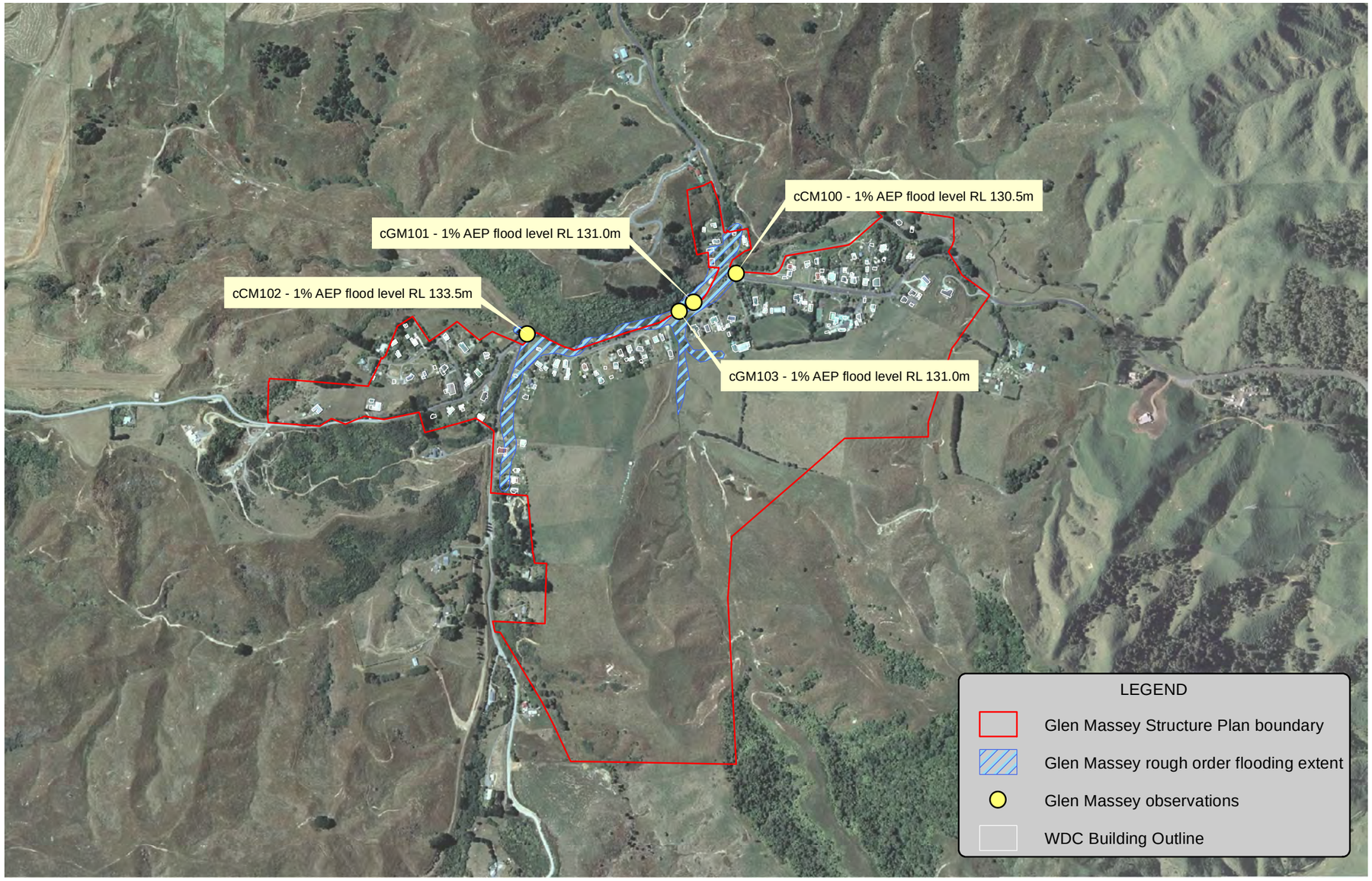
Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Regan Robinson/Bryn Quilter	Peter Cochrane
Civil Engineer/Project Manger	Project Director

BMQ

p:\61814\61814.2000\workingmaterial\catchment management plan\final\150323 appendix d - glen massey final.docx

Appendix DA: Figures

- **Figure 282 Flooding**
- **Figure 292 Ecological Map**



Notes: Aerial photograph supplied by Waikato District Council

A3 SCALE 1:10,000

0 100 200 300 400 500 Meters

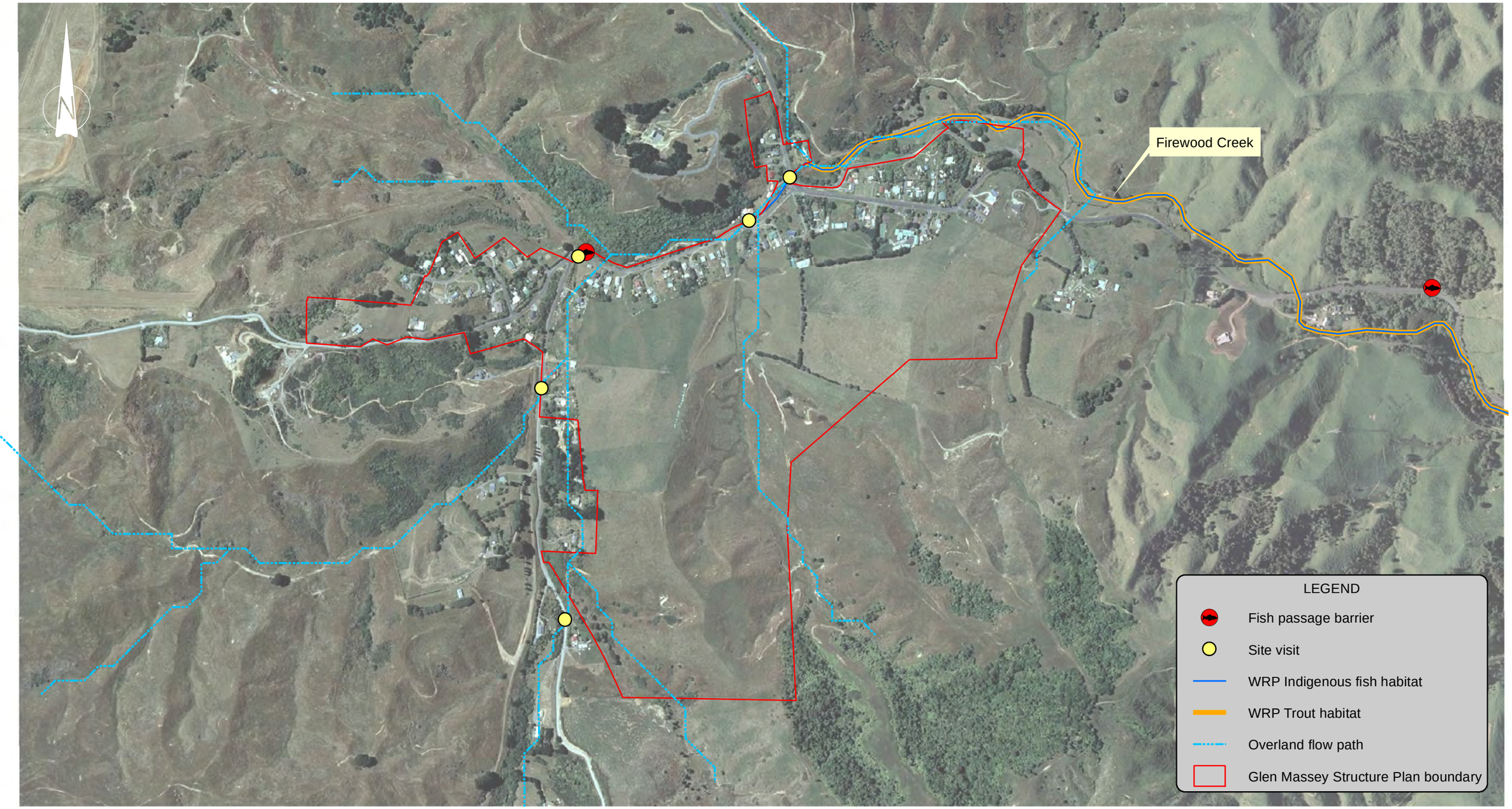
Tonkin & Taylor
Environmental and Engineering Consultants
Level 1, 9 CliftonRoad, Hamilton
www.tonkin.co.nz

DRAWN	DWM	Aug.14
CHECKED	PMC	8/14
APPROVED	BMD	8/14
ARCFILE	61814.200-F282.mxd	
SCALE (AT A3 SIZE)	1:10,000	
PROJECT No.	61814.200	

WAIKATO DISTRICT COUNCIL
CATCHMENT MANAGEMENT PLAN
GLEN MASSEY STRUCTURE PLAN AREA
Flooding Map

FIGURE No. Figure 282 Rev. 0

Path: P:\61814\61814.2000\WorkingMaterial\GIS\61814.200-F282.mxd Date: 21/08/2014 Time: 12:05:56 p.m.



Notes: Aerial photograph supplied by Waikato District Council

A3 SCALE 1:8,000

0 90 180 270 360 450 Meters

Tonkin & Taylor
Environmental and Engineering Consultants
Level 1, 9 CliftonRoad, Hamilton
www.tonkin.co.nz

DRAWN	DWM	Aug.14
CHECKED	PMC	8/14
APPROVED	BMD	8/14
ARCFILE	61814.200-F292.mxd	
SCALE (AT A3 SIZE)	1:8,000	
PROJECT No.	61814.200	

WAIKATO DISTRICT COUNCIL
CATCHMENT MANAGEMENT PLAN OF GLEN MASSEY STRUCTURE PLAN AREA
Ecological Map

FIGURE No. Figure 292 | Rev. 0

Path: P:\61814\61814.2000\WorkingMaterial\GIS\61814.200-F292.mxd Date: 22/08/2014 Time: 2:25:03 p.m.