5 February 2019

Project Director
Health Infrastructure

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PEER REVIEW OF THE TWEED VALLEY HOSPITAL BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT AND ASSESSMENT OF THE MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Dear Sir,

As you instructed, we have completed a peer review of the following two ecological impact assessments for the proposed Tweed Valley Hospital project (the Project), located at 771 Cudgen Road, Cudgen ("the subject site"):

- Greencap (2018). Biodiversity Development Assessment Report: NSW Health Infrastructure Tweed Valley Hospital. Brisbane (the "BDAR report"); and
- Greencap (2018). Matters of National Environmental Significance Report: NSW Health Infrastructure Tweed Valley Hospital. Brisbane (the "MNES report").

The BDAR report has been prepared to comply with the *NSW Biodiversity Conservation Act 2016* (BC Act), while the MNES report has been prepared to address the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The peer review team included four staff from Cumberland Ecology: myself, Ms Cecilia Eriksson, Ms Vanessa Orsborn, and Mr Michael Davis. The peer review team also included Dr Stephanie Clark, a snail specialist. All members of the peer review team have experience with both State and Commonwealth threatened species legislation and have been formally trained for the BC Act. *Curricula vitae* of the team are provided in **Appendix A**.

Drs Robertson and Clark visited the subject site in December 2018 to survey for Mitchell's Rainforest Snail (*Thersites mitchellae*) and examine the windrows of rainforest regeneration present on the Project site. Details of the survey effort are

summarised in Dr Clark's report (**Appendix B**). Dr Clark also provided advice concerning impacts of the Project (as included in **Appendix B**), which has been considered in this peer review process, and by the authors of the BDAR and MNES reports.

Our peer review has been undertaken as an iterative process, commencing with consideration of earlier versions of the aforementioned reports (including the exhibited version of the BDAR), which were prepared as part of the Major Project Application (as exhibited on 1 November 2018) and subsequent revisions made by Greencap in January and February 2019 in response to the peer review.

My staff and I have worked collaboratively with the authors of the two reports and have provided a series of editorial comments and technical recommendations to check and consolidate these reports.

1. Key Findings

We have undertaken a detailed review of the potential for threatened species and ecological communities to occur within the Project site, and have provided recommendations for inclusion of, and further consideration for, additional species in the BDAR and MNES reports.

We are satisfied that the final versions of the two reports are comprehensive and technically fit for purpose to assess the ecological impacts of the project.

Based on our review of the development proposal, and site inspection, it is our opinion that the Project had satisfied the mitigation hierarchy of 'avoidance, mitigation and compensation' for impacts on biodiversity.

This has been achieved by the locating the development footprint within farmland, which is predominantly cleared of native vegetation, and therefore avoids impacts on the areas of high biodiversity value in adjoining areas.

As explained in both the BDAR and MNES reports indirect impacts on the adjoining wetland and rainforest areas would be mitigated against by a comprehensive and appropriate suite of mitigation measures. They include active management of the retained areas of the native vegetation to the north of the development footprint, water cycle management that will lead to improved water quality of run-off entering the areas of conservation significance, and long-term ecological monitoring.

Finally, the residual impacts of the Project have been quantified, and compensation measures proposed, which includes replanting of rainforest vegetation onsite and offsetting with biodiversity credits.

A number of threatened species and endangered ecological communities listed by the both State and Commonwealth threatened species legislation occur, or have potential to occur in the locality in which the subject site occurs, and include:

- Threatened species include but are not limited to Koala (*Phascolarctos cinereus*), Wallum Froglet (*Crinia tinn*ula), Mitchell's Rainforest Snail (*Thersites mitchellae*) and Stinking Cryptocarya (*Cryptocarya foetida*);
- The endangered ecological community of particular relevance to the EPBC Act that occurs in the locality is Lowland Rainforest of Subtropical Australia.

Based upon the highly cleared nature of the proposed development site, we concur with the findings of the BDAR and MNES reports that no vertebrate or invertebrate threatened species are likely to occur and/or make significant use of the rainforest windrows of the subject site.

The peer review team also concur with the BDAR and MNES report that the windrows of regenerating rainforest species are too narrow, too small and too poor in native species composition to conform to EPBC-listed lowland rainforest. As confirmed by our site inspection, and in the peer review report by Dr Clark (see **Appendix B**), no Mitchell's Rainforest Snails are likely to occur within them.

We conclude that no significant impact is likely to occur to any threatened flora and fauna species or ecological communities, including Mitchell's Rainforest Snail and lowland rainforest as a result of the construction or operation of the proposed development. Both the BDAR and MNES reports are comprehensive and technically fit for purpose to assess the ecological impacts of the project.

Yours sincerely

David Robertson

Dr David Robertson
Director
david.robertson@cumberlandecology.com.au

Appendix A

Curricula Vitae

Dr. David Robertson

Director

Dr David Robertson is a senior ecologist with more than 28 year's experience in ecological survey, impact assessment, and research. David is the director of Cumberland Ecology. Dr Robertson is an Accredited Assessor (BAAS17027) for the *Biodiversity Conservation Act 2016.*

Recent consultancy work has included:

- Senior consultant for numerous mining projects in Australia and in the Philippines;
- Court appointed expert for the NSW Land and Environment Court;
- Flora and fauna investigations for Environmental Impact Assessments;
- Development of ecological management plans and habitat reconstruction;
- Negotiations about the level of mitigation measures required for flora and fauna impacts, and development of packages for compensatory habitats.

Key Industry Sectors

- Extractive Industry.
- Power Generation.
- Water.
- Transport.

Education

- Bachelor of Science (Honours), Ecology, University of Melbourne, 1980.
- Doctor of Philosophy, Ecology, University of Melbourne, 1986.

Relevant Experience

Environmental Impact Assessment

Directed numerous large ecological assessments for major EIA projects in a variety of service sectors in Australia and internationally. These include the power industry, water supply, road construction and mining.

Threatened species assessments

Directed or managed numerous threatened species assessments in Australia and overseas to address legislative and policy requirements. Projects were conducted in numerous jurisdictions, involving legal and policy reviews, Work on threatened species has included preliminary survey and impact assessment, detailed impact assessment and mitigation, monitoring and plans of management.

Provision of Strategic Ecological Advice

Strategic ecological advice has been provided to aid the selection of potential development sites in Australia, Hong Kong, Philippines, Thailand, Sri Lanka and China. Included development of selection criteria (e.g. results from community consultation, biodiversity status, land use, project requirements, conservations principles such as connectivity, fragmentation, island theory, edge effects, potential for restoration).

Aquatic Studies

Conducted wide range of aquatic studies, including fish, macro-invertebrates, aquatic and intertidal vegetation (saltmarsh, mangroves); Wetland creation and management projects and aquatic impact assessments.

Statements of evidence and expert testimony

Dr David Robertson is a highly experienced and credible expert witness and is capable of providing expert evidence in both terrestrial and aquatic areas of ecology. David has provided expert evidence for Australian Senate Select Committees, Australian Heritage Commission, Commissions of Inquiry, Land and Environment Court hearings and at Mining Wardens inquiries.

Professional Affiliations

- Ecological Society of Australia
- EIANZ
- CEnvP

Vanessa Orsborn

Project Manager/Ecologist

Vanessa Orsborn has worked as an ecological consultant since 2005, and has extensive experience in ecology and project management. She primarily manages flora and fauna assessments under the EP&A Act and the EPBC Act. As an accredited BAM Assessor, Vanessa assists in the preparation of offset agreements.

Recent consultancy experience has included:

- Assessments for infrastructure upgrades; Transport for NSW (TfNSW) and Roads and Maritime Services (RMS);
- Negotiation of offsets for resources sector project using the BAM, BBAM or BCAM tools;
- Provision of strategic advice for legal privilege;
- Impact Assessments for urban development; and
- Preparation of management plans for offset lands.

Fields of Competence

- Accredited BAM Assessor;
- Commonwealth and State environmental approvals;
- Ecological survey and monitoring; and
- Report writing and liaison with stakeholders.

Key Industry Sectors

- Urban development
- Infrastructure development; and
- Resources

Education

BEnvSci. Australian Catholic University, 2004.

Key Projects

Offset Assessments and Negotiations

As an accredited BAM Assessor, Vanessa has been involved in several project in NSW that are in the process of negotiating biodiversity offsets. The application of the Biodiversity Assessment Methodology (BAM), both for formal and informal offset 'credit' calculations, have been used for a variety of projects.

Legal Projects

BP Australia V Tweed Shire Council: Vanessa assisted in the preparation of documentation prepared as part of the Conciliation process for the Class 1 Appeal of BP Australia V Tweed Shire Council. This included peer review, updating vegetation data and mapping, investigation of offset options, and negotiations with Council.

Japara Healthcare V Northern Beaches Council: The Class 1 Appeal by Japara Healthcare Limited was approved by the Courts, with all ecological issues resolved through 'without prejudice' liaison with Council, for which Vanessa was involved in.

Urban Development Projects

Impact assessments have been prepared by Vanessa for projects across the greater Sydney area and the NSW north and south coasts. Recent Species Impact Statement (SIS) reports for sites in Sydney's north and west have assessed impacts to Critically Endangered Ecological Communities, and have involved offsetting.

Resources Projects

Vanessa has worked on a number of ecological assessments for mining modification projects, including for Integra Mine in the Hunter Valley. Additionally, Vanessa has contributed to Independent Environmental Audits, acting as an ecological specialist assisting the Accredited Auditor, which has included Invincible Mine.

Vanessa has a keen interest in renewable energy projects, and has recently worked on assessments for a Solar Farm in western NSW.

Ecological Management Projects

Vanessa has prepared numerous ecological management plans; for vegetation management, pest species management and also over-abundant native species management.

Infrastructure Upgrade Projects

Vanessa has prepared assessments for a number of road and infrastructure upgrade projects being conducted by RMS and TfNSW. The assessment has included consideration of the relevant RMS and TfNSW Biodiversity Offset Guidelines.

Cecilia Eriksson Pinatacan

Project Manager / GIS Specialist

Experience

Cecilia Eriksson is a Sydney based Project Manager/ GIS Specialist at Cumberland Ecology, who has worked as an ecological consultant since 2014. As a GIS Specialist, Cecilia has detailed technical knowledge and extensive experience in the interpretation and production of digitised mapping, including topographic modelling and classification, and feature extraction using aerial photography and satellite imagery. She is also an experienced project manager and ecologist.

Additionally, Cecilia has detailed knowledge and experience in using the BioBanking Assessment Methodology, the Framework for Biodiversity Assessment (FBA) for Major Projects, and the Bio-Certification Assessment Methodology (BCAM), and has completed the 'BioBanking and BioCertification Assessor Accreditation Course'.

Project Management and Report Writing

Cecilia has managed the ecological components of a suite of small- to large-scale projects, including residential and commercial development applications and rezoning proposals.

In her role as Project Manager/ GIS Specialist she routinely consults with clients, stakeholders, and government agencies.

Cecilia has been the primary author on a variety of documents, including Flora and Fauna Assessments, Species Impact Statements and EPBC Act Referrals.

Geographic Information Systems (GIS)

Recent GIS consultancy work has included:

- Vegetation and threatened flora and fauna mapping for large – and small – scale projects in New South Wales, Queensland, and Northern Territory;
- GIS mapping for and performing BioBanking Assessments, FBA and BCAM on large and small development and offset sites;
- GIS mapping and analysis for Environmental Impact Assessments, Species Impact Statements, Biodiversity Management Plans, and Flora and Fauna Assessments.

Fields of Competence

- GIS (ESRI ArcGIS and MapInfo Professional)
- BioBanking Assessment Methodology (BBAM) , FBA and BCAM;
- Report writing and liaison with stakeholders;
- Ecological field surveys; and
- Statistical analysis (SPSS and Primer).

Education

Master of Science in Marine Science and Management
University of Technology Sydney (2013)

Bachelor of Science (Honours) in Marine Biology
University of Technology Sydney (2008)

Key Projects

NSW Infrastructure Projects

Cecilia has extensive experience working on GIS mapping for NSW infrastructure projects, involving mapping and calculations of clearance areas of native vegetation. Key infrastructure projects include:

- M4 'Westconnex' widening;
- Sydney Light Rail; and
- Epping to Thornleigh Third Track Upgrade (ETTT)

BioBanking Assessments and FBA

Cecilia has been involved in the mapping for and assessment of projects using the BioBanking Assessment Methodology, for small and large development and offset sites. She has extensive experience in using the BioBanking Credit Calculator, and in producing high quality maps for BioBanking Assessment Reports.

Michael Davis

GIS Specialist

Michael Davis is a Sydney based GIS specialist at Cumberland Ecology. As a GIS specialist, Michael has detailed technical knowledge and experience in the interpretation and production of mapping products for ecological projects as well as classification and feature extraction using aerial photography and satellite imagery. At Cumberland Ecology, Michael is closely involved in small and large scale projects and responsible for GIS development, mapping and analyses.

Michael has experience managing projects and is the primary author of a variety of ecological assessments. He has experience in the use of the Bio-Certification Assessment Methodology (BCAM) calculator, the BioBanking Assessment Methodology (BBAM) calculator and has completed the Biodiversity Assessment Methodology (BAM) training course.

Recent consultancy work has included:

- GIS mapping and analysis for various projects for Environmental Assessments, Biodiversity Management Plans, NSW Part 4 development applications and Referrals under the Commonwealth EPBC Act.
- Vegetation mapping, threatened flora and fauna mapping and development footprint mapping for small and large development projects.
- Flora and Fauna surveys and impact assessment including the production of 5-part Tests, Flora and Fauna Assessment Reports (FFA) and Biodiversity Development Application Reports (BDAR).

Fields of Competence

- Geographic Information Systems (GIS)
- Image and spatial data analysis
- Data and project management
- Ecological surveys of flora, fauna and ecological communities within the Sydney region.
- Flora, fauna and ecological community impact assessments

Key Industry Sectors

- Urban development;
- Linear Infrastructure;
- Mining and Extraction industries;
- Government Utilities.

Education

Bachelor of Biodiversity and Conservation, Macquarie University (2015).

Statement of Attainment in ArcGIS & Reporting for Environmental Resource Management, TAFE NSW Ryde (2017).

Key Projects

NSW Development GIS Projects

Michael has provided GIS deliverables for several small to large scale projects in Sydney and throughout NSW. He is experienced in utilising GIS for vegetation mapping, mapping of threatened flora and fauna species, production of field maps and image analysis.

Flora and Fauna Survey and Assessment

Michael has been involved in flora and fauna surveys and impact assessment as part of development applications for a variety of projects in the greater Sydney Metropolitan area. Michael is experienced in performing field assessments under the BioBanking Scheme and the Biodiversity Assessment Methodology. Recent clients include Aver Development and Project Management, Legacy Property, Colliers International and APP Property and Infrastructure Specialists.

Appendix B

Thersites mitchellae (Cox, 1864) (Mitchell's Rainforest Snail) Survey Report

Targeted survey for *Thersites mitchellae* (Cox, 1864) (Mitchell's Rainforest Snail) at 771 Cudgen Rd, Cudgen, NSW, site for the proposed Tweed Valley Hospital

Prepared for Herbert Smith Freehills LLP

Stephanie A. Clark

9 January, 2019

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Introduction

The author was engaged by Health Infrastructure to conduct a targeted survey for the New South Wales endemic land snail *Thersites mitchellae* (Mitchell's Rainforest Snail) at 771 Cudgen Rd, Cudgen, N.S.W, the proposed site for the construction of Tweed Valley Hospital (Figure 1). The purpose of the survey was twofold:

- to determine the nature and extent of habitat and potential habitat for the species on the subject site, particularly within corridors of regenerating rainforest that form narrow strips across the proposed development area (Figure 1);
- to consider whether development of the subject site as a hospital would have a significant impact on the species.

Mitchell's Rainforest Snail is currently listed as critically endangered under the Commonwealth's Environment Protection and Biodiversity Conservation Act, 1999 and as endangered under the New South Wales Biodiversity Conservation Act, 2016.

Previous surveys undertaken both on the site and lands adjoining the development site had found evidence for *Thersites mitchellae* along the northern boundary of the site but in vegetation that is being retained. These are shown as vegetation zones 1, 2 and 3 on Figure 1.

I have relevant qualifications and experience to conduct the survey, as set out in my CV attached at the end of this report.

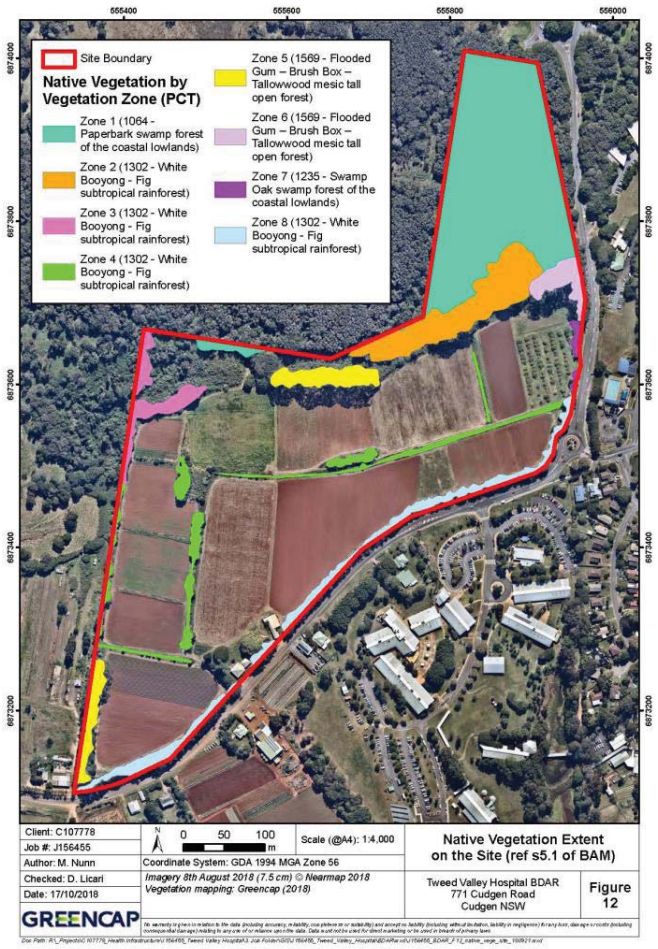

Figure 1. Site map showing the different vegetation zones.

Methods

The author examined draft reports outlining the proposed development of the subject land as the new Tweed Hospital. It was noted that development was proposed in the form of an early works program (various drainage and water management measures) (GeoLink, 2018a), followed by the construction of the hospital itself (GeoLink, 2018b).

The author and two colleagues (Dr David Robertson and Craig Faulkner) visited the site on 19-20th December, 2018, during which conditions appeared suitable to conduct surveys for terrestrial snails. The conditions were warm and dry with relative humidity very high, while only a small amount of rainfall had been recorded at the site in the previous two weeks.

Surveys for snails were conducted both during the day and at night. During the day, logs, rocks and other debris on the ground were turned and the leaf litter was raked. Snails actively crawling on the ground, on logs, rocks and the leaf litter etc, were searched for at night by spotlight (see Table 1 for search effort).

Efforts were concentrated in vegetation Zones 4 and 8 (see Figure 1) to determine if individuals of *Thersites mitchellae* might be present and or that these zones might provide suitable habitat for the species. In addition, the edges of Zones 2, 3 and 5 were searched using spotlights during the night.

The area zoned as Zone 1 in Figure 1, was briefly searched on 20th December, 2018. However, at the time of the site visit it was indicated that this area was no longer included as part of the development site. Given that there are known records for *Thersites mitchellae* (Bionet database searched, 7 December, 2018) both to the east and west of this area and that suitable habitat was present, it was thought highly likely that the species might be present.

Name	19 December	20 December
Dr Stephanie Clark	5 hours	6 hours
Craig Faulkner	5 hours	5 hours
Dr David Robertson		5 hours
Total	10 hours	16 hours

Table 1. Search effort in hours includes both day and night search effort.

Results

No evidence for *Thersites mitchellae* was found within Zones 4 and 8 nor along the edges of Zones 2, 3 and 5.

Land snails were found during the survey period. Three other species of snail were located in Zones 2-5 and 8:

- the non-listed native snails *Sphaerospira fraseri* (Griffith & Pidgeon, 1833) and *Terrycarlessia turbinata* Stanisic in Stanisic *et. al.*, 2010, and
- the introduced snail *Bradybaena similaris* (Férussac, 1821).

Sphaerospira fraseri was the most abundant species recorded with more than 40 living individuals observed crawling on both nights, while *Terrycarlessia turbinata* was the least abundant with only four individuals being observed.

Thersites mitchellae was found in the northern extremity of Zone 1, within paperbark forest (Figure 1). The finds comprised one living individual and three dead shells of *Thersites mitchellae*. The habitat in which they were found is part of a large relatively unfragmented area of swamp forest with a moist understorey and a humid internal microclimate.

Discussion

The proposed development area has been extensively cleared and the remaining corridors of rainforest regeneration occur on well drained land that is relatively dry. They are not suitable habitat for *Thersites mitchellae:*

- The vegetation present in Zone 8 in not suitable habitat for *Thersites mitchellae*, as it is dominated by a line of large pines and otherwise very xeric with very few rainforest plants present along the length of the entire zone.
- The vegetation present in Zone 4 is also not considered suitable habitat for *Thersites mitchellae*, although a number of rainforest plants are present, there is still a high proportion of exotic species

present, the patches are generally relatively narrow and completely surrounded by cleared fields, resulting in the patches being susceptible to drying due to increased exposure to wind blowing across open the fields.

Swamp forest to the north of the site (Zone 1) does support a population of the snail. Similarly, Zones 2 and 3 appear to provide suitable habitat for *Thersites mitchellae*, but due to the fairly dry conditions during the site visit no evidence for the species was observed over the survey period.

It was observed that the existing cleared farmland is on hillsides that drain in unrestricted fashion into the larger blocks of forest and swamp forest on the northern portion of the subject land. The author believes that runoff from farmland may have impacted habitat values for the snail historically. Based upon the early works proposed for the site, and assuming best practice future stormwater management would be implemented for the hospital site, the author believes that it is likely that the future management of runoff may be beneficial to the existing areas of snail habitat to the north of the construction site.

Clearance of the strips of rainforest from the proposed development area (Zones 4 and 8) would not clear or otherwise significantly impact *Thersites mitchellae* habitat. No significant impact is likely upon the species from either the proposed early works program, or the main development proposal for the site.

References

GeoLink (2018a) Preliminary Works – Proposed Tweed Valley Hospital Site: Assessment of Review of Environmental Factors. Prepared by GeoLink for Health Infrastructure

GeoLink (2018b) Environmental Impact Statement: New Tweed Valley Hospital (Concept Proposal and Stage 1 Works). Prepared by GeoLink for Health Infrastructure

CURRICULUM VITAE OF STEPHANIE CLARK

PERSONAL

Business address	Faulconbridge, NSW 2776
Mobile	0426 204 240
E-mail:	meridolum@ozemail.com.au
Citizenship	Australian and American

EDUCATION

Ph.D., 2005. University of Western Sydney, New South Wales, Australia. Taxonomy and conservation.
M.Sc., 1998. Macquarie University, New South Wales, Australia. Taxonomy and genetics.
B.App.Sc., 1990. University of Technology, Sydney, New South Wales, Australia. Major biochemistry.

ACCREDITATIONS ETC

I am the first person to be listed as a Biodiversity Expert under Section 6.5.2.4 of the BAM, under the Biodiversity Conservation Act, 2017 for the snails *Meridolum corneovirens* and *Pommerhelix duralensis* as 16 May 2018.

PROFESSIONAL EXPERIENCE

Current and/or completed:

1997 - present. Consultant work (Invertebrate Identification Australasia - Owner) for various Australian and United States councils, government agencies (State, Commonwealth and Federal), environmental consultancies, mining companies and developers on short and medium term projects dealing mostly with molluscs and insects (particularly endangered species assessments).

Oct 2017 - Completed Biodiversity Assessment Method (BAM) course.

Aug 2017 – Sept 2017. Conduct one day snail identification workshops for the Department of Agriculture & Water Resources, biosecurity biomonitoring sections in Sydney, Melbourne and Perth.

Sept 2016 - Mar 2017. Identified almost 4000 lots of North American land and freshwater molluscs for the Field Museum of Natural History, Chicago, IL.

July 2016 – Dec 2016. Formally describe the US federally endangered freshwater snail, the Banbury Lanx for the Boise Office of the US Fish and Wildlife Service.

Feb 2015 – Mar 2016. Preparing a list of all the names, synonyms and combinations applied to the non-marine molluscs of North America, for the Field Museum of Natural History, Chicago, IL.

Oct 2014 – Feb 2016. Prepare a status report for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) on the Shortface Lanx (*Fisherola nuttallii*) in Canada.

Jan 2013. Conducted a one day workshop on the identification of the endangered Cumberland Land Snail (*Meridolum corneovirens*) for the Ecological Consultants Association of NSW, Mount Annan, NSW, Australia.

June 2011 – present. Contracted with Deixis Consultants to write a Field Guide to the freshwater Molluscs of the Pit-Sacramento Rivers, California by the Cantara Trustee Council Grant Program.

Jan 2010 – Aug 2011. Co-founder and Executive Director, EKOsystems Services, LLP, Chicago, IL.

GRANTS

Clark, S.A. and Harris, P. State of Alabama Department of Conservation and Natural Resources - Distribution, life history, conservation and systematics of Alabama's Pebblesnails. Oct 2004 - Sept 2006. $26,930.

Clark, S.A. Hawkesbury Postgraduate Research Award - PhD, University of Western Sydney. Jan 2000 - Oct. 2002. $47,250.

Ponder, W.F. and Clark, S.A. Australian Biological Resources Study - Interactive CD-Rom guide and key to the freshwater Mollusca of Australia. Jan 1999 - Dec 2001. $90,000.

PROFESSIONAL SOCIETIES

American Malacological Society
Conchological Society of Great Britain and Ireland
Malacological Society of Australasia
The Ecological Consultants Association of New South Wales
Malacological Society of London
Royal Zoological Society of New South Wales
Freshwater Mollusc Conservation Society

Member of the IUCN SSC Mollusc Specialist Group.

RESEARCH INTERESTS

Systematics, population and conservation genetics of invertebrates, particularly terrestrial and freshwater molluscs.

EXPERIENCE

I have over 30 years experience in the collection, identification and taxonomy of marine, estuarine, freshwater and terrestrial molluscs in 16 countries and 40 US states. I have over 12 years experience using allozyme electrophoresis to study speciation and population genetics particularly of molluscs but also some work with reptiles and spiders and at least 5 years experience analysing DNA data. I have about 6 years experience preparing material for and using a scanning electron microscope and have dissected individuals from several hundred populations of freshwater and terrestrial molluscs.

LEGAL EXPERIENCE

I have served as an expert witness for the Land and Environment Court of New South Wales on six occasions since 1997 and have provided expert testimony for several other cases.

PROFESSIONAL ACTIVITIES

Research Associate at the Field Museum of Natural History, Chicago, Illinois, June, 2010 to present.

Vice President of the Chicago Shell Club, Chicago, Illinois, May, 2010 to May, 2016.

Courtesy Postdoctoral Researcher, Division of Malacology at the Florida Museum of Natural History, Gainesville, Florida, September, 2009 to 2016.

Invited participant at the IUCN Red List workshop assessing the Red List status of the world's freshwater molluscs, organised jointly by the Zoological Society of London, the Encyclopedia of Life (EOL), International Union for Conservation of Nature (IUCN), and the IUCN SSC Mollusc Specialist Group. Held in London, United Kingdom, February, 2010.

Served on the Status Review Panel for the federally endangered Idaho Springsnail (*Pyrgulopsis robusta*), in Boise, Idaho, for the United States Fish and Wildlife Service, Western Region, October, 2005.

TELEVISION

Short interview about my PhD project on the endangered endemic Sydney land snail *Meridolum corneovirens*, aired on 'Totally Wild' (a children's educational program on wildlife and the environment), Australia wide, 7 May 2002.

Short interview regarding the endangered endemic Sydney land snail *Meridolum corneovirens* and how the Olympic Coordinating Authority (OCA) has helped in its conservation, aired on 'A Current Affairs' (a prime time news and current affairs program) Australia wide on the 15 September, 1998.

RADIO

Short interview with Brian Bury, 4BC, Brisbane, about Australian native snail diversity aired Nov. 2002.

NEWSPAPER/INTERNET

Several interviews about molluscs, endangered species and rediscovering a species previously thought to be extinct, with national, local and internet media outlets, both in Australia and the United States since 2002.

Some recent examples:
ABC News: When Birds Overshadow Snails -- And Why That's a Problem
http://abcnews.go.com/Technology/story?id=734467&page=1

http://www.cofc.edu/~fwgna/archive/9May05.html

PUBLICATIONS

Keenan, S.W., Audrey T. Paterson, A.T., Niemiller, M.L., Slay, M.E., Clark, S.A. and Engel, A.S. 2017. Observations of the first stygobiont snail (Hydrobiidae, *Fontigens* sp.) in Tennessee. *Proceedings of the 17th International Congress of Speleology* **2017**:91-94.

Campbell, D.C., Clark, S.A. and Lydeard, C. 2017. Phylogenetic analysis of the Lancinae (Gastropoda, Lymnaeidae) with a description of the U.S. federally endangered Banbury Springs lanx. *ZooKeys* **663**:107-132.

Ponder, W.F., Hallan, A., Shea, M. and Clark, S.A. 2016. Australian Freshwater Molluscs. The snails and bivalves of Australian inland waters. Interactive key http://keys.lucidcentral.org/keys/v3/freshwater_molluscs/

Johannes, E.J. and Clark, S.A. 2016. Freshwater mollusc declines, local extinctions and introductions in five northern California streams. *Tentacle* **24**:22-25.

Campbell, D., Clark, S.A., Johannes, E., Lydeard, C. and Frest, T. 2016. Molecular phylogenetics of the freshwater gastropod genus *Juga* (Cerithioidea: Semisulcospiridae). *Biochemical Systematics and Ecology* **65**:158-170.

Gerber, J. and Clark, S.A. 2015. First record of the predatory land snail *Streptostele* (*Tomostele*) *musaecola* (Pulmonata: Streptaxidae) in the continental United States. *American Conchologist* **43(4)**:26-28.

Hauk, A., Clark, S.A., McCravy, K.W., Jenkins, S.E. and Lydeard, C. 2015. A Survey of Terrestrial Gastropods of the Alice L. Kibbe Life Science Station in West-Central Illinois. *Northeastern Naturalist* **22(2)**:299-306.

Bieler, R., Mikkelsen, P.M., Timothy M. Collins, T.M., Glover, E.A., González, V.L., Daniel L. Graf, D.L., Harper, E.M., John Healy, J., Kawauchi, G.Y., Sharma, P.P., Staubach, S., Strong, E.E., Taylor, J.D., Tëmkin, I., Zardus, J.D., Clark, S., Guzmán, A., McIntyre, E., Sharp, P. and Giribet, G. 2014. Investigating the Bivalve Tree of Life – an exemplar-based approach combining molecular and novel morphological characters. *Invertebrate Systematics* **28(1)**:32-115.

Clark, S.A. 2009. Revision of the genus *Posticobia* (Mollusca: Caenogastropoda: Rissooidea: Hydrobiidae s.l.) from Australia and Norfolk Island. *Malacologia* **51(2)**:319-341.

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