

Control and eradication of Australian swamp stonecrop *Crassula helmsii* using herbicide and burial at two ponds at Mile Cross Marsh, Norfolk, England

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SUMMARY

Crassula helmsii (Australian swamp stonecrop or New Zealand pygmyweed) was first recorded growing on Mile Cross Marsh in Norwich, Norfolk, UK before 2003. Previous management undertaken to prevent the spread of this plant across the site had been unsuccessful. A three-phase project was undertaken in 2012 to control *C. helmsii* on Mile Cross Marsh. The aim was to eradicate *C. helmsii* from two infected ponds and reduce the risk of plants spreading through the boundary onto Sweetbriar Marsh Site of Special Scientific Interest. The control programme included herbicide application and *in situ* burial due to the high level of pond infestation. The project successfully achieved its aim of eradicating *C. helmsii* from the infected ponds and preventing the further spread of *C. helmsii* on Mile Cross Marsh. However additional work will be required to fully eradicate the plant from the site.

BACKGROUND

Crassula helmsii is native to Australasia and was probably introduced to Britain from Tasmania in 1911. *C. helmsii* was first found growing naturalised in the UK at Greensted Pond, Essex in 1956. *C. helmsii* can form dense carpets of growth in and around ponds, lakes, reservoirs and ditches, either fully submerged or as emergent growth. *C. helmsii* can outcompete most native plants and quickly becomes dominant, forming a monoculture and reducing biodiversity. It has been shown to be notoriously difficult to control and eradicate with a range of methods (Dawson & Warman 1987). The most effective treatment and eradication options demonstrated for *C. helmsii* have been from a combination approach, comprising herbicide applications followed by covering with an impermeable membrane for an extended period of time, or filling in of infested ponds (Bridge 2005).

Norwich City Council first recorded *C. helmsii* growing on Mile Cross Marsh before 2003. Control work was carried out at that time to prevent the spread of the plant onto the adjacent Sweetbriar Marsh, which is designated as a Site of Special Scientific Interest (SSSI) and protected by UK conservation legislation. Exposed *C. helmsii* plant growth had been treated with aquatic herbicide (glyphosate) during the summer from 2002 to 2005. The control of *C. helmsii* on Mile Cross Marsh was suspended after 2005 as the remaining plant growth was submerged and considered untreatable at that time.

During 2012 Norwich City Council, Norfolk County Council, Natural England and Norfolk Non Native Species Initiative (NNSI) became collaborative partners in the Mile Cross Marsh *C. helmsii* project. The project aim was to eradicate *C. helmsii* from two infected ponds on Mile Cross Marsh. In early 2012 preliminary surveys were undertaken by the collaborative partners. These surveys showed that the majority of *C. helmsii* growth on the site was fully submerged in two small ponds adjacent to the boundary with Sweetbriar Marsh. The survey results were indicative that *C. helmsii* was the dominant species and had formed a high level of monoculture.

No evidence of submerged native aquatic plants was recorded for either pond at the time of survey. However there had been previous reports of the presence of native amphibians in the larger pond but these remained unconfirmed by survey.

An invasive species management plan was agreed by the project partners for the eradication of *C. helmsii* from the two infested ponds. The planning stage used site-specific and survey information to select the most appropriate treatment option available. A decision was taken to use *in situ* burial as the primary control method for both ponds. An *in situ* burial method was selected, in part, due to the low conservation value of both ponds. The low conservation value status was assigned due to the high levels of infestation and absence of identified native plants or any other living macroorganisms. In addition, the infested ponds were deemed to have a very high risk of infecting the adjoining SSSI, which had been determined to have a unique environmental and conservation value.

Funding for the project was agreed and Environment Agency approval for herbicide application was obtained by NNNSI. The project was then put out to tender and Native Landscapes was chosen to undertake the work which included the provision of a final report and follow-up surveys.

The project plan comprised three phases: to initially drain the water from the infected ponds thus enabling effective application of herbicide to exposed *C. helmsii* growth; infilling the infected ponds with on-site material; and finally installing temporary fencing around the filled ponds. Fencing the area on completion was planned to allow protection of the infilled area, preventing unnecessary disturbance and allowing natural regeneration of native vegetation. The burial material required for infilling was planned to be sourced from the site, by creating new ponds in an uninfested area of Mile Cross Marsh approximately 200 metres from the infected ponds (Figure 1). Initially, two new ponds similar to the infected ponds were planned. However, following Native Landscapes consultation with Dr Naomi Edwards at Pond Conservation, it was recommended that the number of new ponds be increased from two to five, to help improve the diversity of habitats on site. Biosecurity measures were agreed for all stages of the management to prevent cross-contamination at the site whilst works were undertaken.

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Figure 1. Mile Cross Marsh: a) existing ponds location, b) proposed new ponds location



ACTION

Timing of operations: Operations were carried out on site during February and March 2012.

Phase 1 - Drain infected ponds and apply herbicide to *Crassula helmsii*: Three weeks prior to phase 2 (excavation work), approximately 100 m³ of water was pumped from the infected ponds into the adjacent infected dyke using a 5 hp petrol-powered water pump (Figure 2a). After both ponds had been drained an additional detailed survey was undertaken. At that time no native aquatic plants were recorded growing. However, approximately 20 common frogs were found in the

remaining pools of water. These were carefully collected in a plastic bucket and transferred to an adjacent *C. helmsii* infected ditch. The infected ditch was used to dispose of the drainage water from both ponds and for the frog site relocation to reduce the risk of additional areas on the site becoming infected. Following these operations a herbicide approved for aquatic use (Roundup Pro Biactive 360 g/l) was applied by knapsack sprayer to all visible *C. helmsii*, at the recommended rate of 6 l/ha.

Phase 2 - Excavate new ponds and fill infected ponds: Five new ponds were excavated on the south side of Dolphin Drain using a 5 ton/ 360° excavator (Figure 2b). The plan for the new

Figure 2. Operations to control *C. helmsii*: a) Draining and filling existing ponds, b) excavating new ponds, c) levelling excavated material, d) fence posts, wire and tape erected.



ponds was adapted on site to improve the overall layout and gain the correct amount of material required for burial. Approximately 120 m³ of extracted material was transported across the site using a 3 ton tracked dumper. The material was deposited from the edges and moved towards the centre of each pond being filled. The site supervisor and subcontractor ensured no physical contact was made between infected plant material and machinery. Transported material was compacted during filling by tracking over with the dumper (Figure 2c). Both ponds were filled 15% higher than the original depth, up to the surrounding ground level, to allow for settling, using the 360° excavator with landscape bucket attachment.

Phase 3 - Construct temporary fencing: Temporary post-and-wire fencing was installed manually to encircle the newly filled ponds (Figure 2d). The materials used were 75 mm round wooden posts and plain galvanised wire. Whilst on site it was agreed that hazard safety tape would be added to highlight the new fencing.

Biosecurity measures: Throughout the contract it was important to ensure that the work undertaken on site did not contribute to the spread of *C. helmsii*. Biosecurity measures were agreed prior to work commencing. The biggest concern was that machinery could come into contact with infected plant material and transfer it across the site to the uninfected site of the new pond location. To prevent this, all machinery used a single route across the site, which avoided infected areas. Excavated material was transported from the newly dug ponds to the infected ponds and deposited from the edge inwards. These areas had previously been treated with herbicide and no living plant material was visible. Machinery was visually checked by the site manager after leaving the infected areas to ensure no plant material was present.

CONSEQUENCES

The work was completed in March 2012 and a detailed survey was carried out in June 2012. No *C. helmsii* was found growing on or around either the newly filled ponds or newly dug ponds. At that time a range of native plants, which were local to this area, had almost fully colonized the filled ponds. In September 2012 the temporary fencing was removed and a further survey took place. The filled ponds had been accessed by ponies kept local to the area and the new vegetation had been grazed.

Annual surveys have been undertaken in 2013, 2014 and 2015. No positive identification of *C. helmsii* growth has been reported for the former pond treatment sites or in the new ponds. Plant growth found on the former pond sites during surveys was mainly grazed mixed grass found locally, as this area is regularly accessed by ponies. A stable plant community is therefore considered to be established.

DISCUSSION

The site-specific control treatment demonstrated here is a modification a previous combination treatment method applied

by Bridge (2005) at Old Moor Reserve in Yorkshire. The use at Mile Cross Marsh of herbicide applications followed by *in situ* burial has demonstrated that the combination approach can be a suitable treatment and eradication method for submerged *C. helmsii* and therefore has the potential to be modified for treatment of other infected sites in the UK. Overall the project was successful in its aim to prevent the further spread of *C. helmsii* from Mile Cross Marsh to the neighbouring Sweetbriar Marsh SSSI. The project exceeded this objective by making alterations to the original layout and design prior to commencement of operations, so that an increased number of new ponds was created.

The main factors considered during the choice of treatment options were evidence of a dominant monoculture of *C. helmsii*, no recorded native plant species in either pond and the close proximity to environmentally sensitive habitats in need of protection from spread of *C. helmsii*. Other issues affecting the decision to fill both ponds included: site location, site access issues, site uses and locating suitable in-fill material. Such factors are likely to be important in identifying other sites at which to apply this approach. More generally a full survey and consultation with relevant environmental partner organisations is recommended for invasive species management in environmentally sensitive areas. This is to enable selection of the most appropriate control methods before any invasive species control work is undertaken.

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