

# Salinity Discharge Mapping for the Grampians Slopes in the Glenelg Salinity Region

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## **SUMMARY**

The objective of this study was to determine the area, severity and location of salinity discharge in the Grampians Slopes and present it in map and database form.

Aerial photos were used for the location of saline sites and an extensive ground truthing program carried out using ISCON techniques for the classification of salt severity.

A total of 117 hectares were found to be salt affected with sites varying in size from 0.08 to 37 hectares. The majority of sites were affected by a low level of salinity, although some were moderately or severely saline. Most of the discharge sites appeared on flats, with some on slopes, in depressions, in drainage lines or around dam margins.

The majority of sites had not been treated. This highlights the need to continue to develop an awareness of salinity in the area and provide funding to assist with treatment of saline areas.

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# **1. INTRODUCTION**

## **1.1 The Glenelg Salinity Strategy & Previous Studies**

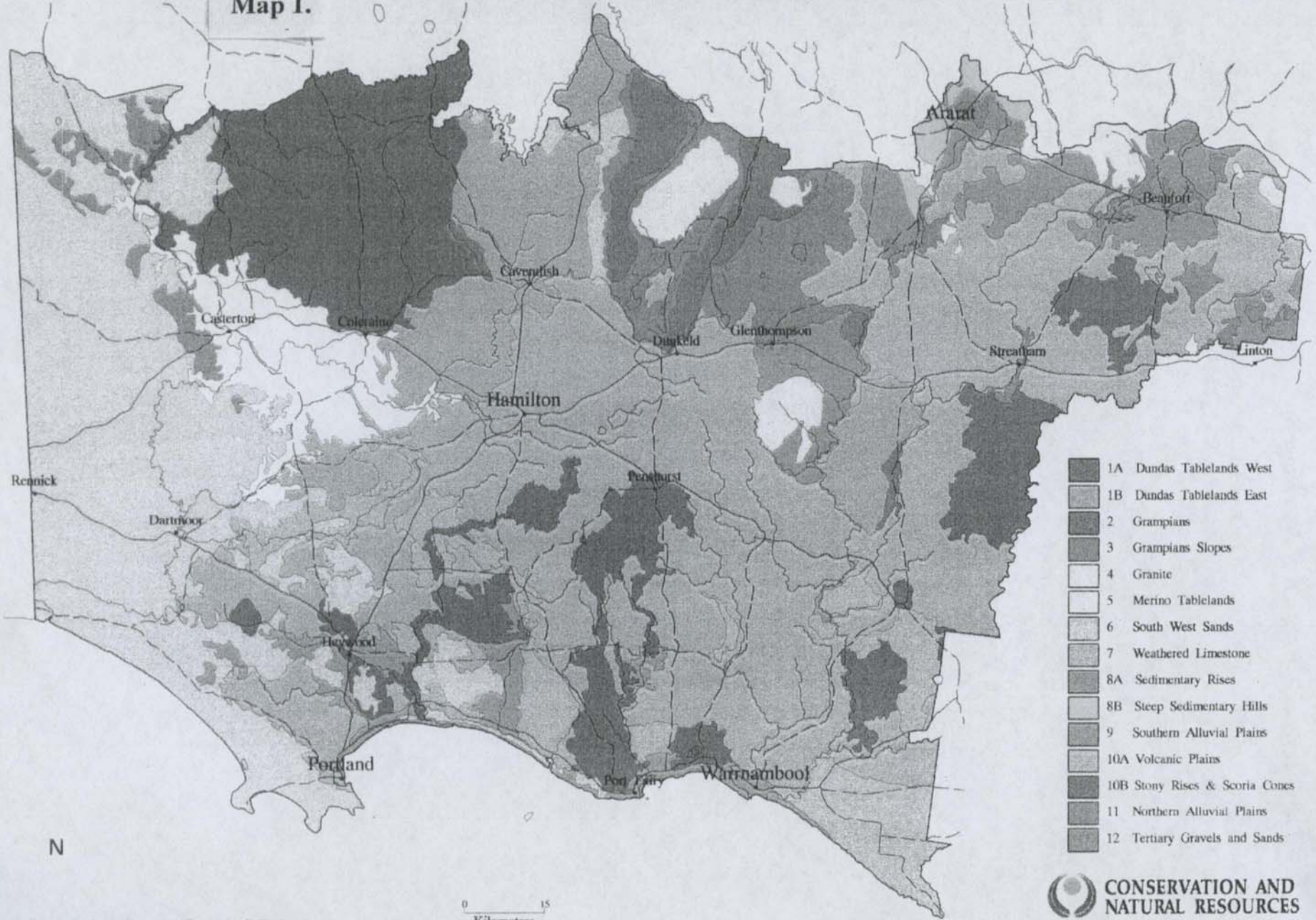
Salinity is one of the most serious forms of land degradation in Victoria and its extent and severity continue to increase (Govt. Victoria, 1988). In the Glenelg Salinity Region alone it has been estimated there are 19 970 hectares of land affected by salt (Ward, 1992) and that the symptoms of salinity cost the Glenelg Regional community over \$2 million each year in lost agricultural production (Glenelg Salinity Forum, 1993).

The Glenelg Region Salinity Forum was set up in 1991 to prepare a strategy to combat the problem of dryland salting in the region. Preliminary estimates of salinity were used to help formulate the strategy. Salinity in the Grampians Slopes LMU (refer to Map 1 for location) had not been mapped completely. Some studies had taken place to the north east of Hamilton (Sturmfels, 1992) and to the north of Cavendish (Ward, 1990). The area thought to be salt affected, however, was largely based on the knowledge of field staff from the Department of Conservation and Natural Resources (CNR) and on observations of individual landholders and landholder groups (Ward, 1992). Due to the subjective nature of some of the salinity discharge data, it was decided in 1993 that a mapping program should begin to improve the accuracy of information. Land management units (LMUs) where the reliability of salinity discharge data was low were to be surveyed first (Glenelg Salinity Forum, 1993). The Grampians Slopes were chosen to be mapped because of this low reliability of information and the large proportion of agricultural land thought to be salt affected.


Some of the areas mapped by Sturmfels (1992) fell within the boundaries of the Grampians Slopes and this information was used in the completion of this study. Whole farm plans from individual landholders were also used where available, although this was not a large source of information.

# Glenelg Salinity Region - Land Management Units

Map 1.



Source: Centre for Land Protection Research, CNR, Bendigo

 CONSERVATION AND NATURAL RESOURCES

Produced by NRS Ballarat, South West Area 18 Oct 94

## **1.2 Objectives of the Study**

The objectives of this study are:

- 1) To determine the extent and severity of dryland salting throughout the Grampians Slopes,
- 2) To define and accurately map salinity discharge areas in the Grampians Slopes,  
and
- 3) To provide base data information for the formulation of salinity control strategies for the Grampians Slopes in the Glenelg Salinity Region.

## **2. DESCRIPTION OF THE STUDY AREA**

### **2.1 Geology and Soils**

Erosion and outwash from the Grampians Ranges have provided the parent material for the Grampians Slopes. The Grampians Ranges are made up of sedimentary rocks of the Upper Devonian - Lower Carboniferous age. They consist of massive beds of hard, quartzose sandstones interbedded with thin, soft, red siltstones and sandstones. Deposition of eroded material has resulted in the Holocene siliceous sands of the Grampians Slopes (Sibley, 1967).

The soils of the Grampians Slopes have a uniform sandy profile, as defined by Northcote (1960), cited by Sibley (1967). Below the darkened sand of the A1 horizon, which is approximately 7 cm deep, is the subsurface soil of the A horizon. This reaches a depth of approximately 90 cm and consists of white sand. The underlying subsoil of the B horizon is made up of yellow, yellowy brown or brown sand and might vary from 1.2 m to 1.5 m in depth. Between the A and B horizons is a thin zone of dark brown sand that forms the B1 horizon. In wet sites this becomes cemented to form a hardpan called "coffee rock". Below the B horizon lies clayey sand or sandy clay. These particular types of nomopodzols are described as organo nomopodzols because of the organic matter that darkens the sand in the B1 horizon (Sibley, 1967).

Nomopodzols are very acidic with pH values ranging from 4.5 at the surface to 5.5 or 6.0 in the deep subsoil. This is associated with low amounts of potassium, calcium, magnesium, copper, zinc, phosphorus and nitrogen (Sibley, 1967).

### **2.2 Topography**

The deep deposits of quartz sand that form the Grampians Slopes take the form of gently sloping sand sheets, with maximum gradients of 5%. They gradually level out toward their boundary with the alluvial plains (Sibley, 1967).

### **2.3 Climate**

The annual rainfall for the Grampians Slopes is between 650 and 800 mm (Bird, Kearney & Jowett, 1994), with most of this falling between April and November (Land Conservation Council, 1979). Frosts may occur for up to two months of the year. Summers are warm with the occasional occurrence of very hot days (Land Conservation Council, 1979).

### **2.4 Vegetation**

Short, dry Schlerophyll forest, including messmate (*Eucalyptus obliqua*), brown stringy bark (*E. baxteri*), apple box (*E. bridgesiana*) and long leafed box (*E. goniocalyx*), grows on the dry upper positions of the Grampians Slopes. Heath woodlands grow on the wetter middle and lower positions (Sibley, 1967).

## **2.5 Landuse**

Seventy five percent of the Grampians Slopes fall within the Grampians National Park. There has been limited agricultural development in the remainder of this LMU because of the characteristics of the soils. The soils are generally infertile and are prone to waterlogging in winter and spring. They have a low water retention in summer and this makes it difficult to support perennial pastures (Sibley, 1967; Hill & Day, 1993). This area is thought to be a recharge zone for local water tables with water entering the system where the sand deposits come in contact with the sandstone of the Grampians Ranges (Glenelg Salinity Forum, 1993). The erosion hazard is high when vegetation is cleared (Sibley, 1967).

### **3. METHODOLOGY**

#### **3.1 Aerial Photographs**

Coloured aerial photos of the area, taken in 1989-91 at an approximate scale of 1:25,000, were used in the study. Those photos which included sections of the Grampians Slopes were selected. Sites that were possibly saline were marked on plastic overlay material on the photos for field checking.

#### **3.2 Field Assessment**

##### *3.2.1 Location of Possible Saline Sites*

Extensive and detailed ground truthing for the positive identification of possibly saline areas was carried out. The farmers who owned the land where each site fell were approached for permission to inspect the area. Where "Whole Farm Plans" had been completed, a check was made to ensure that all saline areas had been located.

##### *3.2.2 Assessment of Site for Salinity Indicators*

Each site was assessed in accordance with the Inventory of Soil Conservation Needs (ISCON) techniques described in detail by Matters (1987) and Matters & Bozon (1989). In brief, a site was inspected for the presence of three or four salt indicator species and other symptoms of salinity. These included the appearance of bare ground, ground water seepage, salt crystals and scalds, erosion as a result of deterioration in soil structure and deterioration or eventual death of trees. Each site was given a severity rating, low (Class 1), medium (Class 2) or severe (Class 3), with the presence of the more salt tolerant species and the increasing appearance of bare ground, salt and the other symptoms of salinity indicating a more severely affected area. Where the site was not purely one class, an estimate of the percentage of each class was made and the overall classification given, as the one with the greatest percentage. Indicator species found and the severity classes which they fall into are listed in Appendix 1. The severity classes, C1, C2 & C3 are described in Table 1.

##### *3.2.3 Water Sampling*

Water samples were taken from dams and at various points along water courses to check the electrical conductivity (EC  $\mu\text{S}/\text{cm}$ ) of the water and confirm the severity of salting.

##### *3.2.4 Defining and Recording Areas*

Areas were marked directly on to the overlays on the photos. Where seeps were too small to be seen on the photos (for example  $10\text{ m}^2$ ) a point or dotted line was used to mark their position and an estimate made of the area by pacing the length and width of the site.

Areas were assessed as being primary or secondary salting. Primary salinity is a natural occurrence and is often evident in the form of saline lakes and wetlands. Secondary salinity, on the other hand, is induced as a result of human activity and occurs when water tables rise, bringing dissolved salts to the surface of the land (Glenelg Salinity Forum, 1993).

**Table 1. Salinity Class Characteristics**

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<b>Class</b>	<b>Severity of Salting</b>	<b>Site characteristics</b>
1	Low	-patchy growth in paddock -reduced vigour of crop or pasture -pastures thin or die out, replaced by more salt tolerant species -no salt crystals or bare patches seen
2	Medium	-species of higher salt tolerance replace Cl indicators -salt stress causes change in leaf shape & colour -salt stains & scalds may appear -bare areas up to 1 square meter
3	High	-only highly salt tolerant plants present -2 or <sup>-1</sup> species dominate -large areas of bare ground -trees may be dead or dying

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from Matters & Bozon (1989)

Additional information about land ownership, landuse, history of appearance of discharge, type of discharge, position of salinity in the landscape, evidence of salinity and treatment of discharge was noted. Each site was given an individual identification number. One number was used for several areas if they were located close together and had similar severities of salting and class indicator species.

All of the information for each site was recorded onto an individual site assessment sheet. A copy of a typical site assessment sheet can be seen using Appendix 2. The completed sheets for each of the sites identified in the study are held at the CNR office in Hamilton.

### 3.3 Maps and Database

Areas were transferred from the aerial photos and overlays ocharacteristics00 map sheets using a Sketchmaster. Seeps that were not able to be drawn onto the aerial photos because they were too small, and therefore shape not recorded, were marked as dots or dotted lines on the mapsheets and area calculated from notes taken. Areas of the larger sites were calculated by counting grid squares ( $1\text{mm}^2 = 25\text{ m}^2$ ) using a planimeter.

Information for each site from the assessment sheets was entered onto a computer database. The database and maps are held at the Hamilton CNR office.

### **3.4 Limitations of the Study**

Only salt indicator species were identified and recorded at each site. Time constraints prevented a detailed botanical survey from being undertaken.

Some areas of the Grampians Slopes were inaccessible due to the nature of the terrain. Inaccessible areas were mapped from the aerial photos. Ground truthing was undertaken on most sites. The reliability of the information for the agricultural areas is estimated at 90%.

Two sites, making up 5% of the surveyed area, were not mapped as part of this study, but were mapped by M. Mackenzie, G. Moore and C. Sturmfels in a series of studies that took place between 1980 and 1987. The results of these studies have been written up in reports by Moore (1984) and Sturmfels (1992). The limitation with this previously mapped information was that the percentage of each severity class had not been estimated and any treatment works that had been carried out were not noted. Position in landscape was recorded from the mapsheets for these two sites as this information had not been recorded either.

Salinity was not extensively searched for in forested areas. No saline sites could be identified from the aerial photos. A systematic search of the entire forested area in the LMU would be required to determine if salinity existed there, and this would not be feasible considering the inaccessibility of most of the country. It is reasonable to assume that the vegetation there would be using enough water to keep the water table and salinity levels down.

## 4. RESULTS

Information about the saline sites identified in this study are shown in a print out of the database in Appendix 3.

### 4.1 Summary Information

The area affected by salinity discharge added up to a total of 117 hectares. The area of agricultural land in the Grampians Slopes is 6,500 hectares, therefore 2% of the farmland in this LMU is salt affected.

There were a total of 35 salt affected sites, averaging 3.3 hectares in size. A note was made of the two sites surveyed by Moore (1984) and Sturmfels (1992) where they could not be presented in the results because of the limitations mentioned earlier. Of all the sites measured the largest was 31.9 hectares and the smallest 0.08 of a hectare.

### 4.2 Type of Salinity

All of the sites were assessed as secondary saline areas. No areas of primary salinity were detected on agricultural or forested land.

### 4.3 Indicators of Salinity

Vegetation and bare ground served as the main indicator of salinity at all of the sites. Groundwater, salt encrustations, scalds, tree deterioration and tree death were less common indicators.

Plant species commonly found throughout the study area were Buck's Horn Plantain (*Plantago coronopus*), Water Buttons (*Cotula coronepifolia*), Swamp Weed (*Selliera radicans*), Sea Barley Grass (*Critesion marinum*) and Australian Salt Grass (*Distichlis distichiphylla*). Sea Barley Grass and Buck's Horn Plantain were found extensively on the flats. In wetter areas, Swamp Weed and Water Buttons were common.

### 4.4 Severity Classes

The results in Table 2 show that most of the area of salt affected land was of low severity (Class 1) salting. Less area was affected by moderate (Class 2) salting and less still by severe (Class 3) salting.

**Table 2. Area of Land in Each Severity Class**

Severity Class	Area (hectares)
1	89
2	17
3	5

NB: Two sites from Moore (1984) and Sturmfels (1992) not included

#### 4.5 Position of Salinity in the Landscape

The majority of saline land was found along drainage lines and on flats. Less area was found in depressions. The least was seen on slopes and around dam edges. These results are shown in Table 3.

**Table 3. Position of Salinity in the Landscape**

Position in landscape	Number of sites	Area (hectares)
DP	9	11
DL	8	50
F	14	46
S	3	5
M	1	

DP = Depression. DL = Drainage line. F = Flat. S = Slope & M = Water-body margin

#### 4.6 Treatment of Salinity

By far the majority of discharge sites were untreated as can be seen from the results in Table 4. Sites where sections of drainage line, but not the entire length, had been treated were recorded as having some treatment. Few areas had been completely treated. The total area of untreated discharge was 106 hectares or 91 percent of the salt affected land in the LMU.

**Table 4. Treatment of Salinity**

Treatment of site	Number of sites	Area (hectares)
Y	2	4
S	1	1
N	33	106

NB: Two sites from Moore (1984) and Sturmfels (1992) not included  
Y = Area treated, S = Some of the area treated & N = Area not treated

## 5. DISCUSSION

The area of agricultural land in the Grampians Slopes affected by salinity discharge is relatively high. Most of the Grampians Slopes are forested, either being part of, or bordering onto, national park. A small proportion of the whole LMU, therefore, is salt affected. The chances of salinity occurring in those forested areas where vegetation is actively using water and preventing the water table from rising and salting land is reduced.

All of the saline discharge appears on land cleared for agriculture, on the outer edge of the slopes where they move away from the ranges and the sand deposits begin to flatten out. If more clearing were to take place the area of saline discharge might increase in the Grampians Slopes themselves. There is also evidence that this LMU acts as a recharge zone for the adjacent Northern Alluvial Plains (Glenelg Salinity Forum, 1993). An increase in water infiltration caused by clearing in the Grampians Slopes could result in increased saline discharge in this adjacent LMU. Further clearing is unlikely, however, because the majority of the LMU falls within national park and elsewhere planning regulations place restrictions on clearing.

Very few of the areas of saline discharge have been treated. Despite an awareness of salinity amongst farmers contacted during the study, financial constraints were preventing some planned treatment programs from being carried out. In several cases saline sites fell on properties owned by absentee landlords, who may or may not be aware of salinity issues. Increasing the awareness amongst these people and assisting others to implement treatment programs needs to continue.

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## Appendix 1. Plant Species Found in Saline Areas

### Salt Indicator Species

<b>Grasses</b>		<b>Salinity Class</b>
Sea Barley Grass	<i>Critesion marinum</i>	1-2
Tall Wheat Grass	<i>Agropyron elongatum</i>	1-2
Australian Salt Grass	<i>Distichlis distichiphylla</i>	2
<b>Small Plants and Shrubs</b>		
Buck's Horn Plantain	<i>Plantago coronopus</i>	1-2
Swamp Weed	<i>Selliera radicans</i>	1-2
Water Buttons	<i>Cotula coronopifolia</i>	2

from Matters & Bozon (1989)

## Appendix 2. Site Assessment Sheet

### DRYLAND SALINITY MONITORING SITE DESCRIPTION SHEET

PHOTO NUMBER: \_\_\_\_\_ SITE NUMBER: \_\_\_\_\_

1:25 000 MAP NAME: \_\_\_\_\_ MAP CO-ORD. \_\_\_\_\_

MAP NUMBER: \_\_\_\_\_ EASTING: \_\_\_\_\_ 00

NORTHING: \_\_\_\_\_ 00

LAND MANAGEMENT UNIT: \_\_\_\_\_ LAND USE: \_\_\_\_\_

LAND OWNERSHIP: \_\_\_\_\_ LANDHOLDER: \_\_\_\_\_

Telephone: \_\_\_\_\_

Postal address: \_\_\_\_\_

**HISTORY:**

Year of clearing: \_\_\_\_\_ Appearance of discharge on site (yr): \_\_\_\_\_

Evidence of discharge (photos, documents, verbal): \_\_\_\_\_

**POSITION OF SALINITY IN LANDSCAPE**

Slope   
Break of slope   
Drainage line   
Lake margin   
Lunette

Flat   
Depression   
Gully   
Sandridge/dune

**TYPE OF DISCHARGE**

Induced  Seep   
Spring   
Combination  Induced \_\_\_\_\_ %  
Natural  \_\_\_\_\_ %

Natural  Salt marsh   
Salt pan   
Salt flat

SALINITY CLASS	EXTENT	
	%	ha.
1		
2		
3		
TOTAL	100	
OVERALL CLASS		

**EVIDENCE OF SALINITY**

Groundwater   
Salt   
Bare ground   
Erosion

Crop/pasture deterioration   
Tree deterioration   
Tree death   
Vegetation (details over)

**TREATMENT OF DISCHARGE**

None  Describe \_\_\_\_\_  
Yes  \_\_\_\_\_

**TREATMENT OF RECHARGE**

None  Describe \_\_\_\_\_  
Yes  \_\_\_\_\_

### Appendix 3. SALINITY DISCHARGE SITES IN THE GRAMPIANS SLOPES

28-Nov-94

SITE No	MAP_NAME	CLASS_1	CLASS_2	CLASS_3	TOTAL_AREA	SEVERITY	TREATDSCR	POSITION
02769	LAKE MUIRHEAD				2.1			DL
02848	LAKE MUIRHEAD				4			DL
03552	BRADY SWAMP	1.875	1.25		3.125	1	N	F
03553	BRADY SWAMP	0.5			0.5	1	N	F
03554	BRADY SWAMP	0.272	0.634		0.906	2	N	F
03556	BRADY SWAMP	0.634	0.272		0.906	1	N	F
03557	BRADY SWAMP	31.875			31.875	1	N	F
03584	ABRUPT	0.062	0.094		0.156	2	N	F
03585	ABRUPT	0.688			0.688	1	N	F
03586	ABRUPT	3.75	0.938		4.688	1	N	DP
03587	ABRUPT	1.125	0.125		1.25	1	N	DP
03589	ABRUPT	0.05	0.356		0.406	2	N	F

SITE No	MAP_NAME	CLASS_1	CLASS_2	CLASS_3	TOTAL_AREA	SEVERITY	TREATDSCR	POSITION
03590	ABRUPT	2.688			2.688	1	Y	F
03591	ABRUPT	2.875			2.875	1	N	F
03592	ABRUPT	0.875			0.875	1	N	F
03593	ABRUPT	4.427	0.781		5.208	1	N	M
03609	MORALLA	0.347	0.084		0.431	1	N	F
03610	MORALLA	0.016	0.065		0.081	2	N	F
03611	MORALLA	0.263	0.175		0.438	1	N	F
03654	BULLAWIN	25.813	7.375	3.688	36.875	1	N	DL
03655	BULLAWIN	2.688			2.688	1	N	DL
03656	BULLAWIN	1.05	0.7		1.75	1	N	S
03657	BULLAWIN	1.438			1.438	1	N	S
03658	BULLAWIN	0.75	0.188		0.938	1	N	B
03659	BULLA WIN		0.219		0.219	2	N	DP
03660	BULLAWIN		1.5		1.5	2	Y	DP

SITE No	MAP_NAME	CLASS_1	CLASS_2	CLASS_3	TOTAL_AREA	SEVERITY	TREATDSCR	POSITION
03661	BULLAWIN	0.832	0.356		1.188	1	S	DL
03662	BULLAWIN		0.124	0.082	0.206	2	N	DP
03663	BULLAWIN		1.35	0.9	2.25	2	N	DP
03664	BULLAWIN	0.094	0.062		0.156	1	N	DP
03665	BULLAWIN	0.197	0.241		0.438	2	N	DP
03666	BULLAWIN	0.3	0.2		0.5	1	N	DL
03667	BULLA WIN	1.875			1.875	1	N	DL
03668	BULLAWIN	0.625			0.625	1	N	DP
03669	BULLAWIN	1.438			1.438	1	N	S
		89.422	17.089	4.67	117.28			

12/05/94

## Appendix 4. SALINITY DISCHARGE IN NEIGHBOURING LMU's

Site No	Map Name	Map Number	AMG E	AMG N	Class 1	Class 2	Class 3	Total area	Severity	Trtmt	Positn Lscape
03453	TEDDY BEAR GAP	7323-2-1	625420	5863950	1.125	0.000	0.000	1.125	1	N	F
03454	TEDDY BEAR GAP	7323-2-1	626200	5863640	0.169	0.019	0.000	0.188	1	S	M
03455	TEDDY BEAR GAP	7323-2-1	627015	5863595	0.000	0.066	0.028	0.094	2	N	F
03456	TEDDY BEAR GAP	7323-2-1	627180	5863465	0.000	1.079	1.240	2.319	3	Y	DL
03457	TEDDY BEAR GAP	7323-2-1	625990	5863310	5.250	0.000	0.000	5.250	1	Y	F
03458	TEDDY BEAR GAP	7323-2-1	628060	5862950	0.000	1.110	1.665	2.775	3	Y	DL
03459	TEDDY BEAR GAP	7323-2-1	625770	5863160	0.329	0.084	0.000	0.413	1	N	DL
03460	TEDDY BEAR GAP	7323-2-1	625595	5863080	0.000	1.306	0.069	1.375	2	Y	DL
03461	TEDDY BEAR GAP	7323-2-1	625770	5862970	0.088	0.037	0.000	0.125	1	Y	F
03462	TEDDY BEAR GAP	7323-2-1	626600	5862700	0.000	3.600	0.900	4.500	2	Y	DL
03463	MIRANATWA	7323-2-2	626285	5862180	0.000	1.650	0.413	2.063	2	Y	DL
03464	MIRANATWA	7323-2-2	625630	5862270	0.250	0.000	0.000	0.250	1	Y	F
03465	TEDDY BEAR GAP	7323-2-1	623820	5863350	2.880	7.590	0.413	10.881	2	S	DL
03466	TEDDY BEAR GAP	7323-2-1	623550	5863550	0.000	0.469	0.000	0.469	2	N	S
03467	MIRANATWA	7323-2-2	624035	5862100	0.000	0.583	0.065	0.648	2	N	M
03468	MIRANATWA	7323-2-2	623890	5862000	0.000	0.088	0.350	0.438	3	N	DL
03469	MIRANATWA	7323-2-2	622950	5861095	0.000	0.569	0.244	0.813	2	N	DL
03470	MIRANATWA	7323-2-2	624250	5860020	0.000	4.394	2.648	7.041	2	Y	DL
03471	MIRANATWA	7323-2-2	624035	5860295	0.000	0.125	0.000	0.125	2	N	M
03472	MIRANATWA	7323-2-2	623870	5860330	0.079	0.236	0.000	0.315	2	Y	DL
03473	MIRANATWA	7323-2-2	623030	5860270	0.525	2.100	0.000	2.625	2	Y	DL
03474	MIRANATWA	7323-2-2	622895	5859950	0.000	1.063	0.000	1.063	2	N	DL
03475	MIRANATWA	7323-2-2	623175	5859550	0.500	0.000	0.000	0.500	1	N	B
03476	MIRANATWA	7323-2-2	623200	5858870	8.813	0.000	0.000	8.813	1	N	DP
03477	MIRANATWA	7323-2-2	623700	5858760	0.000	2.463	0.000	2.463	2	N	M
03478	MIRANATWA	7323-2-2	624150	5858850	3.313	0.000	0.000	3.313	1	Y	DL
03479	MIRANATWA	7323-2-2	624420	5858310	0.188	0.000	0.000	0.188	1	N	DP
03480	MIRANATWA	7323-2-2	624170	5857570	0.000	3.250	0.000	3.250	2	N	DP
03481	MIRANATWA	7323-2-2	623340	5857630	0.206	0.607	0.000	0.813	2	N	S
03482	MIRANATWA	7323-2-2	622720	5858305	0.000	0.406	0.000	0.406	2	N	DP
03483	MIRANATWA	7323-2-2	622535	5858820	1.125	0.000	0.000	1.125	1	N	DP
03484	MIRANATWA	7323-2-2	622550	5857760	0.000	5.175	0.575	5.750	2	N	DL
03485	MIRANATWA	7323-2-2	622730	5857440	0.000	0.094	0.000	0.094	2	N	F
03486	MIRANATWA	7323-2-2	622040	5858600	0.000	0.219	0.000	0.219	2	N	F
03487	MIRANATWA	7323-2-2	621705	5858560	0.094	0.000	0.000	0.094	1	N	
03488	MIRANATWA	7323-2-2	621705	5858405	0.063	0.000	0.000	0.063	1	N	DL
03489	MIRANATWA	7323-2-2	621840	5859020	0.488	2.950	0.000	3.438	2	N	DL
03490	MIRANATWA	7323-2-2	621775	5860080	2.024	4.282	1.069	7.375	2	S	DL
03491	BUULAWIN	7323-2-3	621360	5860930	0.000	1.031	0.844	1.875	2	N	DL
03492	BULLAWIN	7323-2-3	620840	5861100	0.000	0.140	0.016	0.156	2	N	
03493	BULLAWIN	7323-2-3	621070	5860690	0.000	0.338	0.225	0.563	2	Y	DL
03494	BULLAWIN	7323-2-3	620900	5860495	0.000	0.625	0.156	0.781	2	N	DL
03495	BULLAWIN	7323-2-3	620990	5859990	0.000	0.731	1.707	2.438	3	Y	DL
03496	BULLAWIN	7323-2-3	621200	5859100	1.550	2.225	0.225	4.000	2	N	DP

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Site No	Map Name	Map Number	AMG E	AMG N	Class 1	Class 2	Class 3	Total area	Severity	Trtmnt	Positn Lscape
03497	BULLAWIN	7323-2-3	621635	5859020	0.000	0.075	0.000	0.075	2	N	DL
03498	BULLAWIN	7323-2-3	621440	5858870	0.500	0.000	0.000	0.500	1	N	DP
03499	BULLAWIN	7323-2-3	621540	5858820	0.000	0.219	0.000	0.219	2	N	F
03500	BULLAWIN	7323-2-3	621150	5858550	0.000	1.857	0.206	2.063	2	Y	DL
03501	BULLAWIN	7323-2-3	620680	5858800	0.000	1.433	1.040	2.473	2	S	DL
03502	BULLAWIN	7323-2-3	620250	5858790	0.000	1.390	0.000	1.390	2	N	DL
03503	BULLAWIN	7323-2-3	620150	5859160	0.488	1.138	0.000	1.625	2	N	F
03504	BULLAWIN	7323-2-3	619690	5859190	0.000	0.788	0.337	1.125	2	Y	DL
03505	BULLAWIN	7323-2-3	618635	5857030	0.000	0.188	0.000	0.188	2	N	DL
03506	BULLAWIN	7323-2-3	618730	5856630	3.206	0.169	0.000	3.375	1	N	S
03507	BULLAWIN	7323-2-3	617960	5855690	0.000	0.969	0.171	1.140	2	N	DL
03508	BULLAWIN	7323-2-3	617630	5855450	0.000	1.485	0.078	1.563	2	N	DL
03509	BULLAWIN	7323-2-3	620340	5852865	0.000	0.625	0.000	0.625	2	N	F
03510	BULLAWIN	7323-2-3	620350	5852280	0.000	0.500	0.000	0.500	2	N	DL
03511	BULLAWIN	7323-2-3	620100	5852035	1.453	3.391	0.000	4.844	2	N	DL
03512	BULLAWIN	7323-2-3	619930	5851740	0.550	0.138	0.000	0.688	1	N	F
03513	BULLAWIN	7323-2-3	619800	5851650	0.700	0.175	0.000	0.875	1	N	F
03514	BULLAWIN	7323-2-3	618300	5849375	2.488	3.513	0.000	6.000	2	N	DL
03515	BULLAWIN	7323-2-3	618400	5849270	0.700	0.300	0.000	1.000	1	N	DL
03516	BULLAWIN	7323-2-3	618150	5849100	0.000	0.250	0.000	0.250	2	N	F
03517	BULLAWIN	7323-2-3	618100	5848970	0.688	0.000	0.000	0.688	1	N	F
0351.8	BULLAWIN	7323-2-3	617925	5849550	0.000	0.250	0.000	0.250	2	N	DP
03519	BULLAWIN	7323-2-3	617715	5849610	0.563	0.000	0.000	0.563	1	N	DP
03520	BULLAWIN	7323-2-3	617610	5849850	0.625	0.000	0.000	0.625	1	N	DP
03521	BULLAWIN	7323-2-3	616930	5852950	0.125	0.500	0.000	0.625	2	N	F
03522	BULLAWIN	7323-2-3	615860	5854160	0.228	1.597	0.456	2.281	2	N	DL
03523	BULLAWIN	7323-2-3	615740	5853055	0.000	2.078	0.891	2.969	2	N	DL
03524	BRADY SWAMP	7322-1-1	631535	5847600	0.000	0.594	0.000	0.594	2	N	DP
03525	BRADY SWAMP	7322-1-1	632430	5843500	1.531	0.000	0.000	1.531	1	N	F
03526	BRADY SWAMP	7322-1-1	632500	5843260	1.407	0.156	0.000	1.563	1	N	F
03527	BRADY SWAMP	7322-1-1	632495	5843100	3.000	0.000	0.000	3.000	1	N	F
03528	BRADY SWAMP	7322-1-1	632260	5843420	3.063	0.000	0.000	3.063	1	N	F
03529	BRADY SWAMP	7322-1-1	632035	5843260	2.000	0.000	0.000	2.000	1	N	DP
03530	BRADY SWAMP	7322-1-1	631880	5843300	0.188	0.000	0.000	0.188	1	N	F
03531	BRADY SWAMP	7322-1-1	631895	5839860	0.625	0.000	0.000	0.625	1	N	DP
03532	BRADY SWAMP	7322-1-1	631180	5839360	0.657	0.062	0.000	0.719	1	N	F
03533	BRADY SWAMP	7322-1-1	632320	5836215	0.000	0.813	0.000	0.813	2	N	S
03534	BRADY SWAMP	7322-1-1	632050	5835800	0.206	0.482	0.000	0.688	2	N	B
03535	BRADY SWAMP	7322-1-1	630860	5834950	0.531	0.000	0.000	0.531	1	N	DP
03536	BRADY SWAMP	7322-1-1	630625	5834965	2.156	0.000	0.000	2.156	1	N	DP
03537	BRADY SWAMP	7322-1-1	629850	5835670	22.083	0.000	0.000	22.083	1	N	DP
03538	BRADY SWAMP	7322-1-1	628700	5836600	0.938	0.000	0.000	0.938	1	N	M
03539	BRADY SWAMP	7322-1-1	628415	5836240	0.125	0.000	0.000	0.125	1	N	M
03540	BRADY SWAMP	7322-1-1	627875	5836580	0.444	0.000	0.000	0.444	1	N	DL
03541	BRADY SWAMP	7322-1-1	628200	5836740	2.100	0.900	0.000	3.000	1	N	M

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Site No	Map Name	Map Number	AMG E	AMG N	Class 1	Class 2	Class 3	Total area	Severity	Trtmnt	Positn Lscape
03542	BRADY SWAMP	7322-1-1	629760	5839030	1.896	19.416	8.271	29.583	2	N	DP
03543	BRADY SWAMP	7322-1-1	630460	5840300	0.580	0.870	0.000	1.450	2	N	M
03544	BRADY SWAMP	7322-1-1	630125	5840700	4.563	22.088	1.162	27.813	2	N	DP
03545	BRADY SWAMP	7322-1-1	630130	5841250	0.188	0.000	0.000	0.188	1	N	F
03546	BRADY SWAMP	7322-1-1	630100	5841660	1.750	3.250	0.000	5.000	2	N	F
03547	BRADY SWAMP	7322-1-1	628940	5841830	0.719	0.000	0.000	0.719	1	N	F
03548	BRADY SWAMP	7322-1-1	628520	5841570	0.500	0.000	0.000	0.500	1	N	F
03549	BRADY SWAMP	7322-1-1	628400	5841860	2.080	0.000	0.000	2.080	1	N	F
03550	BRADY SWAMP	7322-1-1	628060	5841830	5.000	0.000	0.000	5.000	1	N	F
03551	BRADY SWAMP	7322-1-1	626920	5842275	5.625	0.000	0.000	5.625	1	N	F
03555	BRADY SWAMP	7322-1-1	627000	5842640	5.208	0.000	0.000	5.208	1	N	F
03558	BRADY SWAMP	7322-1-1	627790	5843160	9.375	0.000	0.000	9.375	1	N	F
03559	BRADY SWAMP	7322-1-1	628450	5843100	0.844	0.000	0.000	0.844	1	N	F
03560	BRADY SWAMP	7322-1-1	628175	5843380	0.438	0.000	0.000	0.438	1	N	F
035611	BRADY SWAMP	7322-1-1	628370	5843390	5.250	0.000	0.000	5.250	1	N	F
03562	BRADY SWAMP	7322-1-1	627935	5843505	3.125	0.000	0.000	3.125	1	N	F
03563	BRADY SWAMP	7322-1-1	627720	5843730	2.500	0.000	0.000	2.500	1	N	F
03564	BRADY SWAMP	7322-1-1	627600	5843925	4.167	0.000	0.000	4.167	1	N	F
03565	ABRUPT	7322-1-4	617060	5843350	0.059	0.535	0.000	0.594	2	N	F
03566	ABRUPT	7322-1-4	616870	5843470	0.375	0.875	0.000	1.250	2	N	DL
03567	ABRUPT	7322-1-4	616870	5843255	0.225	0.338	0.000	0.563	2	N	F
03568	ABRUPT	7322-1-4	616450	5842920	0.416	0.178	0.000	0.594	1	N	DL
03569	ABRUPT	7322-1-4	613750	5847400	0.045	0.000	0.000	0.045	1	N	DL
03570	ABRUPT	7322-1-4	613795	5847650	0.188	0.125	0.000	0.313	1	N	F
03571	ABRUPT	7322-1-4	613660	5847720	0.000	0.375	0.000	0.375	2	Y	DP
03572	ABRUPT	7322-1-4	612660	5648120	8.531	10.427	0.000	18.958	2	Y	F
03573	ABRUPT	7322-1-4	612890	5847375	4.333	6.500	0.000	10.833	2	N	F
03574	ABRUPT	7322-1-4	612700	5847100	0.125	0.188	0.000	0.313	2	N	DL
03575	ABRUPT	7322-1-4	612730	5845700	0.000	0.075	0.000	0.075	2	N	F
03576	ABRUPT	7322-1-4	612790	5845250	0.712	0.038	0.000	0.750	1	N	F
03577	ABRUPT	7322-1-4	612690	5845070	1.217	0.064	0.000	1.281	1	N	F
03578	ABRUPT	7322-1-4	612760	5844915	0.802	0.042	0.000	0.844	1	N	F
03579	ABRUPT	7322-1-4	612090	5844700	0.188	0.000	0.000	0.188	1	N	F
03580	ABRUPT	7322-1-4	611935	5844450	4.792	0.000	0.000	0.792	1	N	F
03581	ABRUPT	7322-1-4	611975	5842895	0.406	0.000	0.000	0.406	1	N	F
03582	ABRUPT	7322-1-4	610350	5839740	0.319	2.869	0.000	3.188	2	N	M
03583	ABRUPT	7322-1-4	611165	5840720	0.413	0.962	0.000	1.375	2	N	F
03588	ABRUPT	7322-1-4	614625	5839570	0.000	0.919	0.394	1.313	2	N	DP
03594	ABRUPT	7322-1-4	610620	5838130	14.000	0.000	0.000	14.000	1	N	F
03595	ABRUPT	7322-1-4	610440	5837180	0.700	1.050	0.000	1.750	2	Y	F
03596	ABRUPT	7322-1-4	610380	5837540	2.063	1.375	0.000	3.438	1	Y	F
03597	KARABEAL	7322-4-1	610240	5837570	0.000	0.219	0.000	0.219	2	N	DP
03598	KARABEAL	7322-4-1	610180	5837600	0.150	0.350	0.000	0.500	2	Y	DP
03599	KARABEAL	7322-4-1	610220	5837780	2.625	0.292	0.000	2.917	1	Y	F
30600	KARABEAL	7322-4-1	610230	5838530	0.500	0.750	0.000	1.250	2	Y	F

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Site No	Map Name	Map Number	AMG E	AMG N	Class 1	Class 2	Class 3	Total area	Severity	Trtmnt	Positn Lscape
03601	KARABEAL	7322-4-1	609950	5838945	2.563	0.000	0.000	2.563	1	Y	F
03602	KARABEAL	7322-4-1	609030	5839930	1.167	10.500	0.000	11.667	2	N	F
03603	KARABEAL	7322-4-1	610165	5839800	2.709	1.458	0.000	4.167	1	N	F
03604	KARABEAL	7322-4-1	608455	5839200	0.588	2.550	0.000	3.138	2	S	DL
03605	KARABEAL	7322-4-1			0.000	0.000	0.000	0.000		Y	DL
03606	KARABEAL	7322-4-1	608360	5839850	0.428	1.160	0.000	1.588	2	N	DL
01607	KARABEAL	7322-4-1	608290	5840930	0.000	0.375	0.000	0.375	2	N	F
03608	KARABEAL	7322-4-1	608360	5841145	1.833	7.334	0.000	9.167	2	N	F
03612	MOORALLA	7323-3-2	606055	5850425	0.125	0.000	0.000	0.125	1	N	DP
03613	MOORALLA	7323-3-2	606120	5850710	0.020	0.000	0.000	0.020	1	N	M
03614	MOORALLA	7323-3-2	603920	5851240	0.000	0.125	0.000	0.125	2	N	DL
03615	MOORALLA	7323-3-2	603250	5849140	0.156	0.000	0.000	0.156	1	N	DP
03616	MOORALLA	7323-3-2	602750	5849660	0.000	13.621	5.838	19.459	2	N	F
03617	MOORALLA	7323-3-2	602565	5852950	0.000	1.800	1.200	3.000	2	Y	DP
03618	MOORALLA	7323-3-2	604330	5854130	0.65G	0.000	0.000	0.656	1	N	F
03619	MOORALLA	7323-3-2	603880	5854640	0.095	0.000	0.000	0.095	1	N	DL
03620	MOORALLA	7323-3-2	603750	5854680	0.144	0.062	0.000	0.206	1	N	F
03621	MOORALLA	7323-3-2	603310	5854570	0.063	0.000	0.000	0.063	1	N	F
03622	MOORALLA	7323-3-2	602400	5855370	15.625	0.000	0.000	15.625	1	N	DL
03623	MOORALLA	7323-3-2	602170	5856150	1.125	0.125	0.000	1.250	1	S	DL
03624	MOORALLA	7323-3-2	602120	5856440	0.056	0.500	0.000	0.556	2	S	DL
03625	MOORALLA	7323-3-2	601230	5856125	7.151	0.795	0.000	7.946	1	Y	DL
03626	MOORALLA	7323-3-2	600770	5857180	0.000	0.360	0.240	0.600	2	N	DL
03627	MOORALLA	7323-3-2	600340	5857640	0.000	0.169	1.519	1.688	3	N	DL
03628	MOORALLA	7323-3-2	603220	5857450	0.344	0.000	0.000	0.344	1	N	F
03629	MOORALLA	7323-3-2	603360	5857580	1.313	0.000	0.000	1.313	1	N	F
03630	MOORALLA	7323-3-2	603260	5857210	1.188	0.000	0.000	1.188	1	N	F
03631	MOORALLA	7323-3-2	603660	5857210	0.875	0.000	0.000	0.875	1	N	DP
03632	MOORALLA	7323-3-2	601940	5857880	0.000	0.775	3.100	3.875	3	N	DL
03633	MOORALLA	7323-3-2	602980	5858420	0.000	0.125	0.000	0.125	2	N	DL
03634	MOORALLA	7323-3-2	602650	5858460	0.000	0.258	0.000	0.258	2	N	DL
03635	MOORALLA	7323-3-2	602165	5858730	0.000	1.350	0.338	1.688	2	N	DL
03636	MOORALLA	7323-3-2	600640	5858435	1.640	1.435	2.050	5.125	3	Y	DL
03637	MOORALLA	7323-3-2	601070	5858760	0.000	0.194	0.243	0.437	3	N	DL
03638	MOORALLA	7323-3-2	600725	5859090	0.418	0.929	0.718	2.125	2	S	DL
03639	MOORALLA	7323-3-2	601450	5860130	0.000	0.372	0.159	0.531	2	N	DL
03640	MOORALLA	7323-3-2	601890	5860045	0.094	0.000	0.000	0.094	1	N	DL
01641	MOORALLA	7323-3-2	602290	5859810	0.000	1.675	0.356	2.031	2	N	DL
03642	MOORALLA	7323-3-2	602730	5860250	0.000	0.568	0.072	0.640	2	N	DL
03643	MOORALLA	7323-3-2	602675	5860690	0.000	0.525	0.788	1.313	3	N	DL
03644	MOORALLA	7323-3-2	601670	5861135	0.000	0.750	1.125	1.875	3	N	DL
03645	MOORALLA	7323-3-2	602310	5862550	0.000	0.333	3.000	3.333	3	Y	DL
01646	MOORALLA	7323-3-2	600760	5861330	8.834	9.708	5.000	23.542	2	S	DL
03647	MOORALLA	7323-3-2	599700	5862070	7.988	0.888	0.000	8.875	1	N	DL
03648	MOORALLA	7323-3-2	599925	5858110	0.625	0.000	0.000	0.625	1	Y	S

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Site No	Map Name	Map Number	AMG E	AMG N	Class 1	Class 2	Class 3	Total area	Severity	Trtmnt	Positn Lscape
03649	MOORALLA	7323-3-2	599950	5857770	0.000	0.591	0.253	0.844	2	Y	DL
03650	MOORALLA	7323-3-2	599640	5855230	1.834	0.458	0.000	2.292	1	N	DL
03651	MOORALLA	7323-3-2	599630	5852650	1.050	0.450	0.000	1.500	1	N	DL
03652	MOORALLA	7323-3-2	600490	5852450	0.000	10.500	2.625	13.125	2	Y	DP
03653	MOORALLA	7323-3-2	600470	5852070	0.563	0.062	0.000	0.625	1	N	DP
<b>Total</b>					<b>240.69</b>	<b>223.79</b>	<b>54.482</b>	<b>515.01</b>			